Appendix E
Habitat Survey

HABITAT ASSESSMENTS AND SURVEYS FOR ENDANGERED MAMMALS AT PROPOSED DEVELOPMENT AREAS FOR WESTERN GREENBRIER CO-GEN, GREENBRIER COUNTY, WEST VIRGINIA

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1.0 Regulatory Setting

The federal Endangered Species Act (ESA) [16 U.S.C. 1531 *et seq*.] became law in 1973 and provides for the listing, conservation, and recovery of endangered and threatened species of plants and wildlife. Under the ESA, the U.S. Fish and Wildlife Service (USFWS) strives to protect and monitor the numbers and populations of listed species. Many states enacted similar laws.

Section 7(a)(2) of the ESA states that each federal agency shall insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in destruction or adverse modification of designated critical habitat. Federal actions include (1) expenditure of federal funds for roads, buildings, or other construction projects, and (2) approval of a permit or license, and the activities resulting from such permit or license. This is true regardless of whether involvement is apparent, such as issuance of a federal permit, or less direct, such as federal oversight of a state-operated program.

Section 9 of the ESA prohibits take of listed species. Take is defined by the ESA as "*to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect.*" The definition of harm includes adverse habitat modification. Actions of federal agencies that do not result in jeopardy or adverse modification, but that could result in a take, must be addressed under Section 7.

As part of the environmental studies performed to determine the potential impacts of siting the Western Greenbrier Co-Gen plant near Rainelle, West Virginia, habitat assessments and summer mist netting surveys for the endangered Indiana bat (*Myotis sodalis*) and Virginia big-eared bat (*Corynorhinus townsendii virginianus*), and a habitat assessment for the Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*) were conducted within proposed project development areas. Surveys were conducted in the vicinity of the proposed power plant and transmission line corridor in Rainelle, West Virginia, and at the Anjean waste coal pile. After coordination with U.S. Fish and Wildlife Service (Appendix G), the level of effort required for the Rainelle power plant area was one net site, as well as one net site for the transmission line corridor. Therefore, a total of two net sites were selected and netted.

ESI completed field efforts under Federal Endangered Species Permit TE 023664 and a Scientific Wildlife Collecting Permit # 2004.188 from West Virginia Department of Natural Resources (WVDNR).

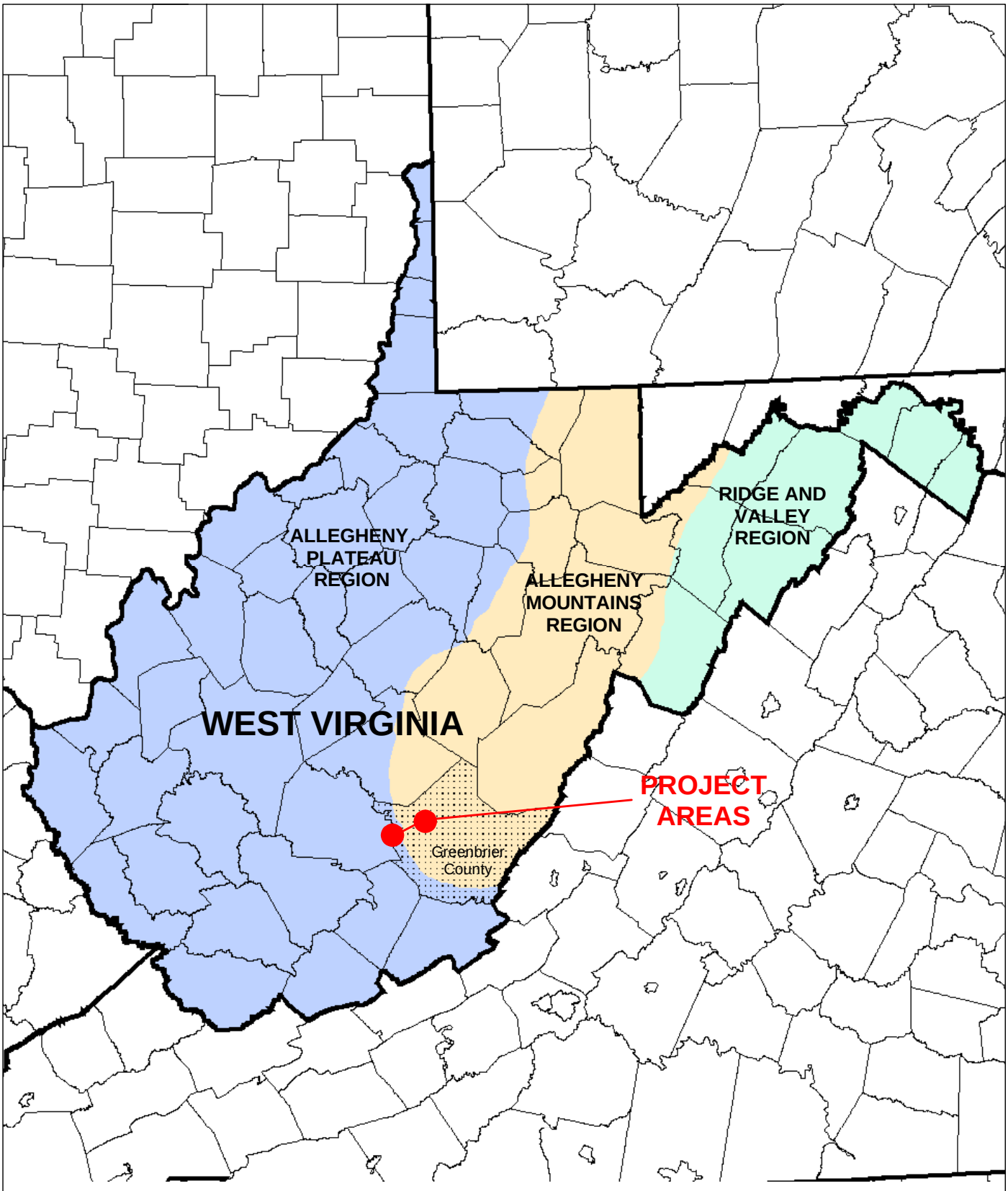
2.0 Project Setting

2.1 Location

The proposed co-generation facility and transmission line corridor are located within and near the City of Rainelle, just east of the Fayette/Greenbrier County line (Figure 1). Separate habitat assessments and netting surveys were conducted in these areas to assess the potential impact to endangered species. A habitat assessment for endangered species was also conducted on a previous surface mine facility on Anjean Mountain, located approximately 7 miles northeast of Rainelle, near the Town of Rupert.

West Virginia is divided between three physiographic regions (Green and Pauley 1987). The Eastern Panhandle of West Virginia lies in the Ridge and Valley region. The Allegheny Mountains region is located on the central portion of state that borders Virginia, and continues north into Pennsylvania and Maryland. Immediately to the west of the Allegheny Mountains, and including over 60 percent of the state, is the Allegheny Plateau. The steep, rugged mountains of the Allegheny Front mark the northern part of the boundary between the Ridge and Valley province and the Allegheny Plateau. The project areas are in Greenbrier County (near the border of Fayette County), where the eastern border of the Allegheny Plateau meets the Allegheny Mountains. Sometimes steep (but gently rolling) hills characterize this area. Ridges, valleys, and associated watersheds tend to run longitudinally northeast to southwest. Abundant caves, caverns, and sinkholes exist in the karst region of Greenbrier County, found several miles east of the project areas.

According to Braun (1950), the project areas are within the Cumberland and Allegheny Plateau Section of the Mixed Mesophytic Forest Region. Originally, undisturbed upper slopes and ridge tops were dominated by red maple (*Acer rubrum*) and several species of oak, including: white (*Quercus alba*), chestnut (*Q. montana*), black (*Q. velutina*), and northern red (*Q. rubra*). Some upland areas were mined and now have early successional forest dominated by black locust (*Robinia pseudo-acacia*), and tree-of-heaven (*Ailanthus altissima*), an invasive exotic species. Forests on relatively undisturbed mesic coves and steep slopes are dominated by tulip poplar (*Liriodendron tulipifera*), sugar maple (*A. saccharum*), American beech (*Fagus grandifolia*), sweet birch (*Betula lenta*), and northern red and white oaks. Mines in the area have created early successional forest and/or openings dominated by herbaceous species. Some areas have no riparian forest, and when present, it is in varying stages of succession, dominated by American sycamore (*Platanus occidentalis*), ironwood (*Carpinus caroliniana*), sweet birch, tulip poplar, and northern red oak.



Source: Buckelew and Hall, The West Virginia Breeding Bird Atlas, 1994.

N W E S

Figure 1. Location of Rainelle Power Plant and Anjean Project Areas in Greenbrier County, West Virginia

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2.2 Regional Species Occurrence

2.2.1 Indiana Bat

The Federally-endangered Indiana bat is known from the region that includes central West Virginia and western Virginia, and has been reported in Greenbrier County. Winter hibernacula occur along the eastern and southern border of Virginia, including Greenbrier, Hardy, Mercer, Monroe, Pendleton, Pocahontas, Preston, Randolph, and Tucker counties. In western Virginia, winter hibernacula have been reported from Bath, Bland, Craig, Giles, Dickenson, Highland, Lee, Montgomery, Tazewell, and Wise counties. Summer records for the area consist primarily of adult males, with sites in Clay and Nicholas counties, West Virginia. Two reproductive female Indiana bats were captured during the summer of 2003 in Boone County, West Virginia, indicating the presence of a summer maternity colony. These captures, located approximately 50 miles west of the project area, represent the first confirmed reproductive records for Indiana bats in West Virginia (Linda Smith, USFWS, pers. comm., 2003).

2.2.2 Virginia Big-eared Bat

The Federally-endangered Virginia big-eared bat is the subspecies of Townsend's big-eared bat that occurs in Kentucky, North Carolina, Virginia, and West Virginia. It inhabits caves during both summer and winter. In winter, the species hibernates in clusters in cool portions of caves, while summer maternity colonies are formed in warmer portions of caves. WVDNR (Craig Stihler, pers. comm., 2002) and USFWS (2001) have been monitoring Virginia big-eared bat populations in West Virginia since 1983. Eleven summer colonies (including eight maternity colonies) and nine winter colonies are surveyed by WVDNR on a regular basis (annually in summer, biannually in winter). In addition to those caves, Virginia big-eared bats have been found in 29 additional caves. Usually these records are for occasional or sporadic occurrences, transients, and historic records. Caves used by the species are concentrated in the northeastern portion of the state: Grant, Tucker, Pendleton, Hardy, Preston, and Randolph counties. The largest single colony is approximately 90 miles to the northeast in Pendleton County. In Virginia, two active Virginia big-eared bat maternity colonies are currently known (Rick Reynolds, VDGIF, pers. comm., 2002); both are over 60 miles away from the project area in Tazewell County.

2.2.3 Virginia Northern Flying Squirrel

The Federally-endangered Virginia northern flying squirrel (*G. s. fuscus*) is known only from the Appalachian Mountains in West Virginia and Virginia. In West Virginia, it has been captured in Greenbrier, Pendleton, Pocahontas, Randolph, Tucker, and Webster counties (USFWS 1990). Known locations in Virginia include Highland, Smyth, Grayson, and Montgomery counties (USFWS 1990). The closest known population is in Cranberry Wildlife Management Area on Monongahela National Forest, about 15 miles northwest of the project areas. This species is closely

associated with higher elevations (>1000 m; >3,280 ft) and coniferous forests of spruce and fir (USFWS 1990). Recent, detailed studies in the southern Appalachians, however, have demonstrated that this squirrel occasionally uses lower elevations (down to approximately 710 m; 2,330 ft) and hardwood forests in proximity to spruce or hemlock (C. Stihler, pers. comm.).

3.0 Natural History of the Indiana Bat

3.1 Status

Federal Register Documents

41 FR 41914; 24 September 1976: Final Critical Habitat, Critical habitat—mammals
40 FR 58308 58312; 16 December 1975: Proposed Critical Habitat, Critical habitat—mammals
32 FR 4001; 11 March 1967: Final Listing, Endangered

The USFWS listed the Indiana bat (*Myotis sodalis*) as endangered on 11 March 1967. The most current range-wide estimate of the population is 382,000 individuals (Clawson 2002), which represents about 43 percent of the estimated population of 1960. Long-term, detailed documentation of population changes are lacking in many areas, although Indiana is an exception (Brack et al. 1984, 2003; Johnson et al. 2002). It is probable that summer habitat losses (USFWS 1999) and winter disturbances (Johnson et al. 1998) contributed to the overall decline of the species.

The Indiana bat is a "tree bat" in summer and a "cave bat" in winter. There are four ecologically distinct components of the annual life cycle: winter hibernation, spring staging and autumn swarming, spring and autumn migration, and the summer season of reproduction. The U.S. Fish and Wildlife Service Recovery Plan (1999) provides a description of the life history. Figure 2 provides an annual chronology of seasonal activities.

3.2 Winter Hibernation

The winter range of the Indiana bat is large and is restricted to regions of well-developed limestone caves where it overwinters in approximately 300 known hibernacula. Most hibernacula are in caves, but abandoned mines (Kath 2002; Hicks and Novak 2002; Brack et al. in prep) are sometimes used. There are large populations of Indiana bats in only a few caves, while most hibernacula contain only a few bats. Hibernacula with large populations of Indiana bats are concentrated in southern Missouri, Indiana, and Kentucky. Smaller wintering populations occur in Alabama, Arkansas, Connecticut, Georgia, Illinois, Iowa, Maryland, Massachusetts, Mississippi, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, and West Virginia.

Hibernation is an adaptation that allows survival through the winter months when food and water are not abundant. Indiana bats hibernate from mid-November to mid-April. Many species of bats (including the Indiana bat) make relatively characteristic and recognizable use of hibernacula, including temperature regimes and spatial

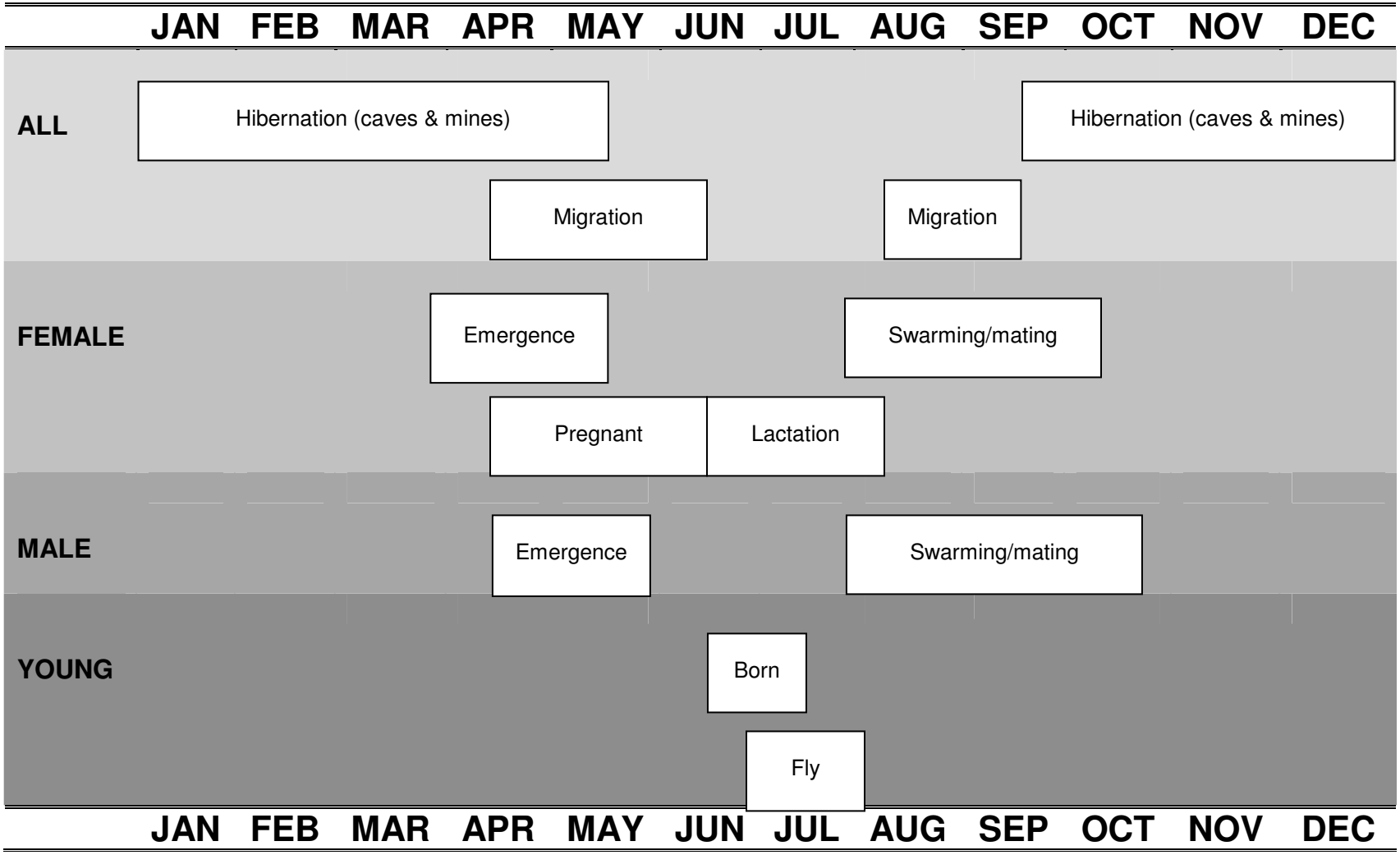

Figure 2. Seasonal chronology of Indiana bat activities.

associations (Brack 1979, Brack et al. 2003; Brack and Twente 1985; Twente et al. 1985). Hibernating Indiana bats often form dense clusters on cave ceilings in portions of the cave where winter temperatures are suitable. Initially, this temperature was believed to be 4 to 8ºC (or perhaps more narrowly 3 to 6ºC during mid-winter (USFWS 1999), but these assertions (Hall 1962; Henshaw and Folk 1966; Humphrey 1978) were supported with scant data. Recent analysis of long-term data in hibernacula with increasing numbers of Indiana bats indicates the optimal range is closer to 6 to 8ºC (Myers 1964; Clawson et al. 1980; Brack et al. 2003; Brack in prep; Brack and Reynolds in Prep: Brack et al. in prep; Brack and Reynolds in prep). Therefore, Indiana bats use areas that are cool, but thermally stable. Colder areas, especially areas closer to the entrance, are often unstable. Clusters of bats are not sexually segregated.

3.3 Spring Staging and Autumn Swarming

3.3.1 Spring

Female Indiana bats leave hibernacula earlier in spring (beginning in mid-April) than do males (peak of departure in early May). This part of spring activity is referred to as staging. In spring, after emerging from hibernation, bats may remain near hibernacula caves for a few days before leaving for summer maternity areas. They may use this time to help prepare for migration.

3.3.2 Autumn

Autumn swarming is a term used to describe the activity of microchiropteran bats at hibernacula in North America (Cope and Humphrey 1977) and Europe (Parsons et al. 2003) during autumn. It is the use and visitation of hibernacula and nearby habitats in late summer and early autumn, and for many species is associated with the opportunity for sexes to meet and mate.

In autumn, Indiana bats swarm at caves used for hibernation, although individuals probably come and go throughout the autumn season. Cope and Humphrey (1977) indicated that “waves” of Indiana bats begin to return to a hibernacula in southern Indiana in low to moderate numbers in mid to late August. Also in Indiana, Brack (1983) found the first individuals arriving as early as late July. In Missouri, LaVal and LaVal (1980) indicated that individuals begin to return to hibernacula in early August.

During swarming, the abundance of females increases and decreases with the season, but males are always more common (Cope and Humphrey 1977; Laval and LaVal 1980). Numbers of swarming females peak in September. By late September, many females are hibernating while many males remain active until mid-October or later, apparently in an effort to breed late-arriving females. Small males with insufficient fat reserves to survive winter may remain active in hibernacula seeking to copulate before dying (Richter et al. 1993). Temperature and precipitation likely influence swarming chronology. For example, rain has been shown to depress

swarming activity in Europe (Parsons et al. 2003). Large, wet cold-weather systems may be part of the seasonal cycle driving the timing of swarming (Brack in prep). Females store sperm through hibernation and delay fertilization until spring (Wimsatt 1944). It is not known if juvenile females mate their first autumn. Limited mating may occur in spring (Hall 1962).

During early stages of autumn swarming, Indiana bats visit hibernacula at night, but may roost in woodlands during the day, often near the cave: 0.5 mi (0.8 km) in Virginia (Brack in prep) and 1 mi (1.9 km) in Kentucky (Gumbert 2001). In Virginia, Indiana bats used a variety of species of live, dying, and dead roost trees (Brack in prep). Individual bats roosted in multiple roost trees, which were sometimes used for 2 to 3 consecutive days. Many roosts were near canopy openings including selective cut, clear-cut, and pastured woodlands with scattered trees. Roosts were also found near or along logging roads or powerline corridors. Bats also used roost trees in forests with moderate to high canopy closure. Compared to availability, roost trees were located disproportionately more often in open, intermediate, and closed deciduous forests rather than mixed deciduous/evergreen forest. Roosts found in agricultural areas bordered croplands. In Virginia, there was no difference between sizes of roost trees used by females and males (17.5 vs. 15.5 in; 44.4 vs. 39.3 cm), height of roost above ground (37 vs. 40 ft; 11.4 vs. 12.2 m), or elevation where roost trees were found (2,750 vs. 2.950 ft; 839 vs. 900 m). There was no difference between species of roost trees used by male and female bats throughout the autumn season, as well as no discrimination between living or dead trees (Brack in prep). As the autumn season progresses, more bats roost in the hibernacula caves.

In Virginia, nocturnal activity areas were 237 to 907 ac (96 - 367 ha; $\bar{X}$ = 251 ha), with a great deal of overlap among activity areas of individuals (Brack in prep). Bats in the Virginia project area were proportionately more active in open deciduous forests, even though there was less of that habitat available in the area (19.0% vs. 9.5%). They were less active in mixed deciduous-evergreen forests and closed deciduous forests, even though the habitat types were significantly more abundant in the area (Brack in prep). Thus, Indiana bats foraged in relatively open habitats, consisting primarily of pastures with scattered trees, within this Virginia project area. Many pastures (agricultural lands) in the Virginia project area had scattered trees that abutted woodlands, with a gradation from pasture to woodlands, and open woodlands were generally recently-logged tracts with a scattering of individual trees. Bats were active across all elevations in the Virginia project area. Many bats included an existing powerline ROW (a notable feature on a forested landscape) in their active area. Bat activity shifted among habitats over the autumn season (Brack in prep). Use of agricultural lands dropped steadily over the season; conversely, use of deciduous forests (combined open, intermediate, and closed) increased, possibly in response to insect availability.

As the autumn season progresses, nightly bat activity begins earlier in the evening. As temperatures cool seasonally, nocturnal insects have a limited activity period; consequently, so do the bats (Brack in prep; Parsons et al. 2003). It is probable that many bats leave the hibernaculum area periodically during autumn swarming (Brack in prep; Gumbert 2001). It is not known why bats leave, but departures during swarming have implications for reproductive fitness since it reduces or eliminates the opportunity to mate. Possibly, bats visit and mate at other swarming locations. Alternatively, males actively seeking mating opportunities may need to intermittently leave the swarming area to forage and replenish energy supplies.

3.4 Spring and Autumn Migration

Little is known about bats during migration. In general, females are more migratory than males (Whitaker and Brack 2002; Brack 1983). Females from a single hibernaculum may end up at maternity colonies over a large geographic area, and females from a single maternity colony may end up in different hibernacula (Barbour and Davis 1969; Gardner and Cook 2002; Kurta and Murray 2002). It is probable that bats use a variety of roosts, including trees, caves, mines, holes of various types, and possibly a variety of non-traditional roosts during migration. Bats migrating from hibernacula in southeastern New York to summer maternity sites roosted in trees and on a building – in a gap between a cinderblock wall and a joist under an elevated deck (Sanders and Chenger 2001), as well as in the siding of a house and in trees of suburban yards. In late summer, a juvenile Indiana bat was found on the side of a building in central Indiana that had a roughed cement exterior (Brack, unpublished data). In northern Ohio, several Indiana bats have been caught in autumn in sandstone crevices that likely serve as a migratory stop-over (Summit County Metro Parks 2003). During migration, other species of bats have been found in a variety of unlikely locations, including ships at sea, log piles, and rodent holes in treeless areas (Brack and Carter 1985).

3.5 Summer Roosting Ecology

The summer range of the Indiana bat is large and includes much of the eastern deciduous forestlands between the Appalachian Mountains and Midwest prairies. Distribution throughout the range is not uniform and summer occurrences are more frequent in southern Iowa and Michigan, northern Missouri, Illinois, and Indiana. Greater tree densities do not equate to more bats (Brack et al. 2002). Cooler summer temperatures associated with latitude or altitude likely affect reproductive success and the summer distribution of the species (Brack et al. 2002).

3.5.1 Males

Some males remain near hibernacula throughout summer while others migrate varying distances (Whitaker and Brack 2002). Males can be caught at hibernacula on most nights during summer (Brack 1983; Brack and LaVal 1985), although there may be a large turnover of individuals between nights (Brack 1983).

Woodland roosts appear similar to maternity roosts (Kiser and Elliott 1996; Schultes and Elliott 2002; Brack et al. 2004; Brack and Whitaker 2004), although smaller diameter trees may be used. Less space may be required for a single bat than a colony of bats, or thermal requirements may differ. Males appear somewhat nomadic; over time, the number of roosts and the size of an area used increases. Activity areas encompass roads of all sizes, from trails to interstate highways. Roosts have also been located near roads of all sizes (Kiser and Elliott 1996; Schultes and Elliott 2002; Brack et al 2004), including adjacent to an interstate highway (Brack et al. 2004).

3.5.2 Females and Maternity Colonies

When female Indiana bats emerge from hibernation, they migrate to maternity colonies that may be located up to several hundred miles away (Kurta and Murray 2002). Females form nursery colonies under exfoliating bark of dead, dying, and living trees in a variety of habitat types, including uplands and riparian habitats. A wide variety of tree species (occasionally including pines [Britzke et al. 2003]) are used as nursery colonies, indicating that it is tree form, not species, which is important for roosts. Since many roosts are in dead or dying trees, they are often ephemeral. Roost trees may be habitable for one to several years, depending on the species and condition of the tree (Callahan et al. 1997). Indiana bats exhibit strong site fidelity to summer roosting and foraging areas (Kurta and Murray 2002; Kurta et al. 2002).


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A maternity colony typically consists of 25 to 325 adult females. Nursery colonies often use several roost trees (Kurta et al. 1993; Foster and Kurta 1999; Kurta et al. 2002), moving among roosts within a season. Most members of a colony coalesce into a single roost tree about the time of parturition, which begins to break up again as soon as young are volant. Roosts that contain large numbers of bats (>20 bats) are often called primary roosts, while secondary roosts hold fewer bats. Primary roost trees are often greater than 18 inches (45 cm) dbh and secondary roost trees are often greater than 9 inches (22 cm) dbh (Gardner et al. 1991; Callahan et al. 1997; Kurta et al 2002; Miller et al. 2002; Carter 2003). Numerous suitable roosts may be required to support a single nursery colony, possibly about 20 stems per acre (45/ha) (Gardner et al. 1991; Miller et al. 2002; Carter 2003).

Roost trees are often located where they have solar exposure, with 20 to 80 percent canopy closure (Humphrey et al. 1977; Gardner et al. 1991; Kurta et al. 1993, 1996, 2002; Carter 2003). They are often exposed to 10 or more hours of solar radiation per day (Kurta et al 2002). The need for solar exposure may vary with latitude. Although maternity colonies of Indiana bats typically roost under the exfoliating bark

of dead and dying trees, they have also been found roosting in buildings, one in Pennsylvania (Butchkoski and Hassinger 2002) and one in a barn in Iowa (unpubl. report), and bat boxes (Whitaker et al., in submission). Individuals that were likely part of maternity colonies have been found in bat boxes (Carter 2002), and various tree hollows and tree cracks (L. C. Watkins in Humphrey et al. 1977; Kurta et al. 1993, 2002).

Females are pregnant when they arrive at maternity roosts. Fecundity of the species is low, for females produce only one young per year. Parturition typically occurs between late June and early July. Lactating females have been caught 11 June to 29 July in Indiana, 26 June to 22 July in Iowa, and 11 June to 6 July in Missouri (Humphrey et al. 1977; LaVal and LaVal 1980; Brack 1983; Clark et al. 1987). Juveniles become volant between early July and early August. Reproductive phenology is likely dependent upon seasonal temperatures and the thermal character of the roost (Humphrey et al. 1977; Kurta et al. 1996). Like many microchiropterans, Indiana bats are thermal conformists (Stones and Wiebers 1967), with prenatal, neonatal, and juvenile development temperature dependent (Racey 1982). Cooler summer temperatures associated with latitude or altitude likely affect reproductive success and therefore the summer distribution of the species (Brack et al. 2002).

Nightly non-foraging behavior of Indiana bats is poorly documented. In Michigan, pregnant bats from a maternity colony foraged most of the night, but lactating females returned two to four times to feed young. Both pregnant and lactating females roosted up to six times per night for 14 minutes each (*SD* = 1; Murray and Kurta 2004). Foraging areas were 0.3 to 2.5 mi (0.5 - 4.2 km) from diurnal roosts. Kiser et al. (2002) found 82 bats under three bridges over a 6-night period in late July and August. Temperatures under the bridges were warmer and less variable than ambient, apparently providing a location to hang and digest food between foraging bouts. These bridges were 0.6 to 1.2 mi (1.0 - 1.9 km) from diurnal roost trees.

Indiana bats live on anthropogenic landscapes and recent research indicates females do include roads in their active area. Although bats do cross roads, the studies that document this behavior were not designed to gauge a graded response. On Camp Atterbury, Indiana, female and juvenile Indiana bats routinely night roosted under bridges on 2-lane paved roads (Kiser et al. 2002). Activity areas of nursery colonies in Illinois (Gardner et al. 1991) and Michigan (Kurta et al. 2002) included paved roads. On the campus of Wright State University, Ohio, a roost tree was located at the edge of a large parking lot, and about 60 ft (20 m) from a moderately traveled road. Emerging bats crossed the parking lot and radio-tagged bats crossed highway 444, a 4-lane divided highway to forage in a 180-ac (73 ha) woodlot (Brown et al. 2001). A female Indiana bat from a maternity roost tree on the west edge of the Indianapolis, Indiana, Airport and north of Interstate 70, routinely crossed this 6-lane interstate to forage (Brack, unpublished data). In eastern Indiana, adjacent to Newport Chemical Depot, a reproductive female Indiana bat was radio-tracked

across a 4-lane divided highway to a maternity colony in a small (1.7 ac; 0.7 ha), isolated woodlot (Brack and Whitaker, in prep). The roost tree was on the west edge of the woodlot, adjacent to the highway and the woodlot was surrounded on other sides by open, farmed agricultural lands.

3.6 Food Habits and Foraging Ecology

The diet of Indiana bats differs depending on age and sex, but often includes a variety of insects that vary by habitat and season. Based on diets of males, Brack and LaVal (1985) considered the species selective opportunists. In Indiana, aquatic-based insects were more common in the diet of a maternity colony than in the diet of males collected at caves (Brack 1983). The maternity colony was located along the Big Blue River, where only about 11 percent of the land within 2 mi (3.2 km) of the roost was forested (most was riparian), whereas males were caught at a cave where 42 percent of the area within 2 mi (3.2 km) was forested and only a small portion was riparian. In late summer, the diets of males, females, and juveniles captured at caves were similar to one another and to males' summer diets. Diets reported by Belwood (1979) from a colony along a stream and by Kurta and Whitaker (1998) from a colony within a wooded wetland contained more aquatic-based insects than diets of males foraging in an upland habitat (Brack and LaVal 1985). The repeated seasonal occurrence of the Asiatic oak weevil, *Cyrtepistomus castaneus* and sporadic abundance of hymenopterans in the diet (Brack 1983; Brack and LaVal 1985; Brack and Whitaker 2004; Brack in submission) are both indicative of opportunistic feeding. Insects may be less common late at night, forcing bats to eat a greater variety of insects (Brack 1983). Later in the season when insect abundance is greater, they may eat a less diverse diet (Brack and LaVal 1985; Brack 1983). Diet also varies by lunar cycle (Brack 1983; Brack and LaVal 1985; Brack in submission), because the cycle affects insects. Murray and Kurta (2002) found that the diet was flexible across the range and potentially affected by regional and local differences in bat assemblages and availability of foraging habitat and prey.

Distances Indiana bats travel to forage may be quite variable. Using reflective wristbands, Humphrey et al. (1977) found that a maternity colony foraged in areas ranging in total from 3.7 to 11.1 ac (1.5 - 4.5 ha). In Illinois, individuals traveled up to 2.5 mi (4.2 km) from maternity colonies (Gardner et al. 1991). In Michigan, foraging areas were 0.3 to 2.5 mi (0.5 - 4.2 km) from diurnal roosts (Murray and Kurta 2004), and members of a maternity colony moved a maximum distance among roosts of 3.6 mi (5.8 km) overnight, but 5.7 mi (9.2 km) over 4 years (Kurta et al. 2002). In Missouri, adult males traveled 3.1 miles while foraging (LaVal and LaVal 1980), and Brack (1983) observed foraging light-tagged bats within 2 miles of caves used during autumn swarming. In Hoosier National Forest, the mean active foraging area of four adult male bats ranged from 95.1 to 151.9 ha based on the method of estimation, while the means of individual bats across three methods of estimation (95% minimum convex polygon, capture radius, and non-circular) ranged from 43.1 to 314.2 ha (Brack et al. 2004). Active areas used by individual bats often overlap. Individuals of

many species of bats that roost colonially forage independently of one another (Kerth et al. 2001). Like many other species of microchiropterans, the Indiana bat often uses travel corridors that consist of open flyways such as streams, woodland trails, small infrequently used roads, and possibly utility corridors, regardless of suitability for foraging or roosting (Brown and Brack 2003).

Members of maternity colonies forage in a variety of woodland settings, including upland and floodplain forest (Humphrey et al. 1977; Brack 1983; Gardner et al. 1991). Foraging activity is concentrated above and around foliage surfaces, such as over the canopy in upland and riparian woods, around crowns of individual or widely spaced trees, and along edges. They forage less frequently over old fields, and occasionally over bushes in open pastures. Forest edges, small openings, and woodlands with patchy trees provide more foraging opportunities than dense woodlands. Most species of woodland bats forage prominently along edges, less in openings, and least within forests (Grindal 1996). Openings also provide a better supply of insects than do wooded areas (Tibbels and Kurta 2003).

4.0 Natural History of the Virginia Big-eared Bat

4.1 Status

On 30 November 1979, the Virginia big-eared bat (C*orynorhinus t. virginianus*) was listed as a federally endangered subspecies of Townsend's big-eared bat (*C. townsendii*) under the Endangered Species Act of 1973. Listing was related to the small population size, an isolated and limited range, and the potential for human disturbance. A recovery plan for the species was completed on 8 May 1984 (USFWS, 1984). Critical habitat was designated for the species on 30 November 1979. Critical habitat includes five caves in Pendleton and Tucker counties, which are in the northeastern part of the West Virginia.

Federal Register Documents

44 FR 69206 69208; 30 November 1979: Final Critical Habitat, Critical habitat—mammals/final Listing, Endangered

44 FR 51144 51145; 30 August 1979: Proposed Critical Habitat, Critical habitat—mammals

44 FR 12382 12384; Notice Withdrawal of Critical Habitat

42 FR 61290 61292; 02 December 1977: Proposed Critical Habitat, Critical habitat—mammals/Proposed Listing, Endangered


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The Virginia big-eared bat occurs in Kentucky, North Carolina, Virginia, and West Virginia. It inhabits caves during both summer and winter. In winter, the species hibernates in clusters in cool portions of caves, while summer maternity colonies are formed in warmer portions of caves (Lacki et al. 1993; Clark et al. 1996). Bats migrate between cold winter hibernacula and warm summer maternity caves, but colonies appear to occupy nearly the same geographic area year round. If a cave has areas that cool properly in winter and areas that warm adequately in summer, the same cave may be used during both summer and winter (Whitaker and Hamilton, 1998). Virginia big-eared bats are rarely recovered more than 20 miles (32.2 km) from the banding site (Harvey, 1992); however, a long-distance record of 40 miles (64.4 km) is known from Kentucky (Barbour and Davis, 1969). Harvey et al. (1981) found that Ozark big-eared bats (*C. t. ingens*) in Arkansas moved approximately 4 miles (6.5 km) from hibernaculum to maternity roost. In Virginia, movements of 14 miles (22.5 km) between maternity roosts and hibernacula have been recorded; in West Virginia, movements of 7.3 miles (11.7 km) have been recorded.

4.2 Winter

Virginia big-eared bats often use colder or well-ventilated areas of the cave during hibernation (Barbour and Davis 1969; Humphrey and Kunz 1976). Hibernating Virginia big-eared bats are often found in loose clusters, although some roost singly

(Adam 1992). Age and sex segregation does not occur during hibernation (Whitaker and Hamilton 1998).

In Oklahoma, Ozark big-eared bats move among hibernacula throughout winter (Clark et al. 2002). In West Virginia, clusters of hibernating big-eared bats are seemingly more easily aroused than are other species of bats (Brack pers. obs.). In Oklahoma, the Ozark big-eared bat (Clark et al. 2002), and in West Virginia, the Virginia big-eared bat (Stihler and Brack 1992) hibernated in colder portions of the cave (above freezing) than most concentrations of other bat species.

Copulation occurs in autumn, but ovulation, fertilization, and gestation do not occur until the following spring. Ovulation takes place around the time that females leave the hibernaculum (Pearson et al. 1952). Juvenile females typically mate during their first season while juvenile males do not (Adam 1992).

4.3 Summer

Female Virginia big-eared bats form maternity colonies in late March or early April that may number from several to hundreds of individuals. Colonies are usually located in warm caves (or portions of caves) or rock shelters (Pearson et al. 1952; USFWS 1984). Females leave their young nightly to forage, but may return to the cave to nurse early in the season after parturition. As the season progresses, females typically remain gone all night and sometimes use an alternate day roost. During the maternity period, males are apparently solitary (Pearson et al. 1952; Barbour and Davis 1969; Humphrey and Kunz 1976), although bachelor colonies (loose aggregations of individuals) may be formed.

Parturition typically occurs in late spring and results in one large pup weighing nearly 25 percent of the post-partum mass of females. Newborn bats are naked and their large ears lie over their unopened eyes for the first few days. Within a few hours after birth, they can produce audible chirps that may play an important role in mother-infant recognition. Young bats grow rapidly, nearly reaching adult size in one month. Juveniles become volant at 2.5 to 3 weeks and are weaned by 6 to 8 weeks (Adam 1992; USFWS 1995; USFWS 1984; Kunz and Martin 1982; Pearson et al. 1952).

Natality rates are comparable throughout the range of the species, varying from 90 to 100 percent (USFWS, 1995; Humphrey and Kunz 1976; Pearson et al. 1952). Pre-weaning post-natal mortality was 4 percent in Kansas and Oklahoma (Humphrey and Kunz, 1976). In California, Pearson et al. (1952) found that only 38-40 percent of yearlings returned to maternity colonies, but nearly 80 percent of each cohort returned in 3rd and 4th years. Maximum longevity is 16 years 5 months, based on band recoveries in California (Paradiso and Greenhall 1967 *in* USFWS 1995).

4.4 Food Habits and Foraging Ecology

Like many other bats, the Virginia big-eared bat uses echolocation to capture insect prey in flight (Kunz and Martin 1982; Whitaker and Hamilton 1998). The presence of spiders in the diet provides evidence of gleaning (Brack and Dalton in prep). In Tazewell County, Virginia, moths (Lepidoptera) were the most commonly eaten insect prey (Dalton et al. 1986; Brack and Dalton in prep). The bats ate predominately moths (often with a body length of about 20 mm), but forage over, near, and around foliage in several habitats: pastures, croplands (alfalfa and corn), shrub lands, riparian strips, and wooded corridors and woodlands. The bat eats a variety of pest species and may be susceptible to impacts from insecticides and other lepidoteracides such as Dimilin and the bacterium *Bacillus thuringiensis*. In 1,222 samples from April to September, Dalton et al. (1986) found that moth remains were in 97 percent of samples, and accounted for at least 80 percent of the material in most samples. Coleopterans (beetles), Dipterans (flies), Hymenopterans (bees, ants, wasps, and kin), Homopterans (cicadas and kin), and Neuropterans (net-veined insects) were also consumed.

In West Virginia, moths were 96.7 percent of the food volume eaten by Virginia big-eared bats at three maternity colonies (Sample and Whitmore 1993). Light tagging and telemetry studies in West Virginia (Stihler 1994; 1995) indicated that the species forages in woodlands, old fields, hay fields, and sometimes-grazed pastures; however, recent clear cuts were not used. In West Virginia, forested habitats appear to be used with greater frequency in July than in May.

In Kentucky, the Virginia big-eared bats spent a large amount of time over grassy fields (Burford and Lacki 1995). The Ozark big-eared bat in Oklahoma used edge habitats of intermittent streams and mountain slopes more than expected based on available habitat (Clark et al. 1993), while range, edge, and forest habitats were generally used in proportion to their availability, although males in September showed a disproportionately high use of forested habitats (Wethington et al. 1996). Gary P. Bell (pers. comm. *in* Kunz and Martin 1982) noted that the western subspecies forages mostly along forested edges. In coastal California, this species foraged primarily along edges of riparian vegetation (Fellers and Pierson 2002).

Virginia big-eared bats may travel several miles to forage. Individuals from a maternity colony in West Virginia (Cave Mountain Cave, Pendleton County) often traveled 3.1 to 4.3 miles (5 to 7 km) from the maternity cave to feed (Stihler 1994). The closest point in Pendleton County is at least 70 miles (113 km) away from the Rainelle/Anjean project areas (Figure 1). These bats usually foraged in the same general area on consecutive nights, but some bats used more than one foraging area. In a similar study, Stihler (1995) documented a maximum foraging distance of 6.5 miles (10.5 km) and noted that most bats appeared to utilize more than one foraging area. Bats often used anthropogenic structures (abandoned houses, barns, out buildings, and bridges) as night-roosts near the foraging area, and sometimes did

not return to the main roost at dawn. In Tazewell County, Virginia, some bats returned to the cave to night roost, but some roosted in woodlands and on two occasions, bats roosted in a shed (Brack and Dalton in prep). In autumn, very little time was spent night roosting (0.2%), but in spring, 18.3% of time was spent night roosting. In Kentucky, big-eared bats night-roosted extensively in sandstone cliffs with a wide variety of physical features (Lacki et al. 1993). In Oklahoma, distances traveled by foraging female big-eared bats increased and nightly visits to the roost decreased as lactation progressed (Clark et al. 1993; 2002). In September, in California, females consistently traveled farther than males from the maternity roost site, and alternate day roost consisted mainly of tree hollows (Fellers and Pierson 2002).

In Oklahoma (Clark et al. 2002) and California (Fellers and Pierson 2002), traveling big-eared bats apparently followed tree lines and forest edges in preference to crossing open areas. Interestingly, none of the foraging studies cited above document the use of free water (i.e., drinking).

5.0 Natural History of the Virginia Northern Flying Squirrel

5.1 Status

Federal Register Documents

67 FR 71192 71193; 29 November 2002: Notice plan HCP
50 FR 26999 27002; 01 July 1985: Final listing, Endangered
49 FR 45880 45884; 21 November 1984: Proposed listing, Endangered

The Virginia northern flying squirrel was listed as endangered by the USFWS on 1 July 1985. There are 25 subspecies of *Glaucomys sabrinus*; and only two, *G. s fuscus* and G. s. *coloratus*, are endangered. While the range of both is restricted to mountaintops of the Appalachians, *G. s. fuscus* is found along the border between Virginia and West Virginia, while *G. s. coloratus* is found along the border between Tennessee and North Carolina. *G. s fuscus* is susceptible to natural and human-caused events because of its small, isolated range (USFWS 1990); it is known from only six counties in West Virginia (including Greenbrier County) and four in Virginia. Therefore, destruction of habitat and other human-caused disturbances could cause further fragmentation to already disjunct populations.

Because of the vulnerability of *G. s. fuscus*, a recovery strategy was enacted by the USFWS. This recovery strategy includes a survey of capture sites and other suitable habitats to identify the distribution of *G. s. fuscus* in the southern Appalachians. Once the distribution is determined, habitats that support the species must be protected from human disturbances, more information on the ecology of these squirrels and their relationship with *G. volans* must be collected, and enhancements of habitats and the subsequent responses of squirrels to these changes must be monitored.

Northern flying squirrels are small squirrels with large eyes and loose, furred skin that connects their wrists and ankles. Total body length is 260 to 305 mm and weight varies from 90 to 140 g (USFWS 1990). They have soft, dense fur and a relatively long, flattened tail that aid in gliding (Wells-Gosling and Heaney 1984). Color of the fur varies depending on sub-species; however, the fur typically is grayish-brown dorsally and grayish-white to buffy-white ventrally (Wells-Gosling and Heaney 1984). Northern flying squirrels sometimes have gray on the face and sides of the head (Wells-Gosling and Heaney 1984).

The northern flying squirrel is distributed throughout forests of northern North America; however, *G. s. fuscus* is limited to the Appalachian Mountains of west-central Virginia and eastern West Virginia (Odum et al., 2001; USFWS 1990; Wells-Gosling and Heaney 1984). Within this restricted range, these squirrels occupy

forested habitats at high elevations. In Virginia, individuals typically inhabit forests at 3,840 to 5,350 ft (1,170 to 1,630 m); in West Virginia, they generally occur at 3,280 to 4,430 ft (1,000 to 1,350 m) (USFWS 1990). Forested regions inhabited by *G. s. fuscus* include coniferous and deciduous forests, as well as ecotones of these two forest types (USFWS 1990). Coniferous forest that includes spruce (*Picea* spp.), hemlock (*Tsuga* sp.), or fir (*Pseudotsuga* sp.) seemed to be preferred (Payne et al. 1989; Weigl 1978; Weigl and Osgood 1974); however, *G. s. fuscus* is sometimes found in mature, deciduous forest. The composition of these woodlands usually consists of beech (*Fagus grandifolia*), yellow birch (*Betula alleganiensis*), sugar maple, red maple (*A. rubrum*), and black cherry (*Prunus serotina*) (USFWS 1990; Weigl 1978). Although *G. s fuscus* has been documented in forests of varying age and understory composition, most individuals have been captured in mesic, old-growth forests with many mature trees and snags (Payne et al. 1989; USFWS 1990). In West Virginia, these squirrels are known from mixed conifer-hardwood forests containing old growth and open understories (Weigl and Brinson, unpubl. data).

5.2 Life History

These nocturnal mammals occupy relatively large home ranges for their size, traveling long distances during the night (Weigl and Brinson unpubl. data). They are active throughout the year despite low temperatures. Individuals use a variety of nest types, including cavities of trees in winter, outside nests in trees, and even underground nests (Hackett and Pagels 2003; USFWS 1990; Wells-Gosling and Heaney 1984). Shredded bark, moss, lichens, grass, and other available materials are used to line nests (Wells-Gosling and Heaney 1984). Suitable nesting sites are important to the species because of adverse weather and the variety of predators that eat them (USFWS 1990). Many owls, as well as other avian predators and mammalian predators, are known to prey on northern flying squirrels (Wells-Gosling and Heaney 1984).

Northern flying squirrels are social animals and often share nests. For example, in West Virginia, seven adults were observed together in one nest box and four in another (USFWS 1990). Little information is available on reproduction in *G. s. fuscus*; however, data suggest they have only a single litter in spring or summer (USFWS 1990). In Virginia and West Virginia, litters ranged from one to five individuals (USFWS 1990).

5.3 Food Habits and Foraging Ecology

Although the northern flying squirrel feeds on a variety of nuts, fruits, insects, and animal material, fungi and lichens are important food items in certain parts of their distribution (Loeb et al. 2000; Wells-Gosling and Heaney 1984). In West Virginia, tree buds, lichens, and hypogeous fungi were the most predominant food items eaten by *G. s. fuscus* in spring; in fall, hypogeous and epigeous fungi and beechnuts were most common (Mitchell 2001). Because hypogeous fungi eaten by *G. s. fuscus* form mychorrhizal relationships with trees, northern flying squirrels may contribute to the

health of mixed coniferous and hardwood forests by aiding dispersal of various species of mycorrhizal fungi (Mitchell 2001).

Boreal forests in northern North America, particularly spruce-fir and northern hardwood forests, are critical habitats for northern flying squirrels. The endangered *G. s. fuscus* currently occupies only isolated patches of suitable forests in the Appalachian Mountains (USFWS 1990). Evidence suggests that a combination of hardwoods and conifers, such as spruce and fir, are important to this species in the southern Appalachians (USFWS 1990). Loss of this habitat from timber harvest, mining, pollution, introduced pests, and other human-related events has reduced the available habitat and further isolated populations (USFWS 1990). Furthermore, competition from southern flying squirrels in areas where they are sympatric may be contributing to the decline. Both species of flying squirrels occur in Virginia and West Virginia and laboratory data suggest that *G. volans* may displace *G. s. fuscus* from nesting sites (Weigl 1978). In addition, a parasitic nematode (*Strongyloides robustus*) carried by southern flying squirrels may be lethal if transferred to northern flying squirrels (USFWS 1990).

6.0 Methods

6.1 Bat Habitat Assessment

Bat habitat assessments focused on features indicative of suitability for Indiana bats and Virginia big-eared bats. Separate habitat descriptions were completed for each project area (Rainelle, Transmission Line, and Anjean) and at each individual net site (Appendix A). The emphasis of these descriptions was habitat form: size and relative abundance of large trees and snags that potentially serve as roost trees for Indiana bats, canopy closure, understory clutter/openness, distance to water, stream or pond characteristics, and flight corridors. Habitat form was emphasized because the Indiana bat roosts in numerous tree species. Although Virginia big-eared bats only roost in caves, they forage in wooded areas. Tree species composition was included because it provides insight to edaphic conditions of each site.

Habitat characterization identifies components of canopy and subcanopy layers. Trees that reach into the canopy are canopy trees, regardless of diameter/size. As defined in the Indiana Bat Habitat Suitability Index Model (3D/Environmental, 1995), dominant trees are the large trees in the canopy (>16" dbh) that have the greatest likelihood of being used by maternity colonies of Indiana bats. Many smaller trees are often also found in the canopy, and in some situations, the canopy can be entirely composed of small-diameter trees. ESI's habitat characterization identifies dominant and subdominant elements of the canopy.

The subcanopy vegetation layer is well defined in classical ecological literature. It is that portion of the forest structure between the ground vegetation (to approximately 2 ft (0.6 m)) and the canopy layers, usually beginning at about 25 ft (7.6 m).

Vegetation in the understory may come from:

- Lower branches of overstory trees
- Young overstory trees
- Small trees and shrubs that are confined to the understory

The amount of vegetation in the understory is termed clutter. Many species of bats, including the Indiana bat and Virginia big-eared bat, tend to avoid areas of high clutter.

Other site-specific parameters pertinent to assessing the quality of the habitat were also recorded, such as distance to water, stream habitat (if present), standing water in an upland site, and travel corridors – or lack thereof. Each net site was documented with a sketch when possible. Figures 3 and 4 identify the specific locations of each habitat assessment site within the project areas.

6.2 Flying Squirrel Habitat Assessment

Flying squirrel habitat assessments focused on features indicative of suitability for Virginia northern flying squirrels. Separate habitat descriptions (Appendix B) were completed for each project area (Rainelle, Transmission Line, and Anjean). The emphasis of these descriptions was location and habitat form. Overall habitat suitability, including nesting and foraging potential, were evaluated using the following characteristics: elevation, size and relative abundance of large trees and snags that potentially serve as nesting areas, presence of cavities in trees, species composition of trees and understory, presence of lichens and fungi, and distance to water. Elevation was emphasized because *G. s. fuscus* typically inhabits elevations above 3,280 ft (1,000 m). Presence of lichens and fungi, potential food sources, was noted. Tree species composition was included because *G. s. fuscus* prefers coniferous forest that includes spruce, hemlock, or fir, although mature, deciduous forest is sometimes used. Figures 3 and 4 identify the specific locations of each habitat assessment site within the project areas.

6.3 Visual Inventory of Mammals

Visual inventories of existing mammals were conducted in the three project areas, primarily using pedestrian surveys. Separate species lists were made for each project area (Rainelle, Transmission Line, and Anjean). The presence of mammalian species was determined by visually observing live or dead animals, or by locating tracks or scat. Appendix C contains completed Mammal Inventory Checklists.

6.4 Mist Netting

Efforts to survey for endangered bats are difficult to standardize because of the large amount of variability that exists in a field situation. However, implementation of netting guidelines provided by the U.S. Fish and Wildlife Service (1999) in the most recent (Agency Draft) revision of the Indiana Bat Recovery Plan have provided some structure. These guidelines (Table 1) were employed during netting of the 2 sites (Rainelle and Transmission Line).

The survey at each site consisted of two net sets run for two nights, for a total of four net nights of effort per site. Since there were two sites, netting was completed in four calendar nights. Netting at both sites was conducted between 13 to 16 July 2004. Nights of netting were consecutive, but needed not be. Net placement was based upon canopy cover, presence of a flight corridor, water, and habitat conditions near the site. Nets were set to maximize coverage of flight paths potentially used by Indiana bats and Virginia big-eared bats along suitable corridors. Site selection was based upon an expectation of greatest bat activity and an effort to provide survey coverage of the study area. Nets are often placed over streams used as travel corridors and sometimes for foraging. However, survey areas were mainly upland, so nets were set in upland corridors, which are very effective for bat capture (Brown and Brack 2003), particularly near sources of drinking water (Wilhide et al. 1998). The precise location and specific orientation of each net was determined in the field.

Table 1. Mist Netting guidelines.

1. Netting Season: 15 May to 15 August, when Indiana bats occupy summer habitat.
2. Equipment (Mist Nets): constructed of the finest, lowest visibility mesh commercially available – monofilament or black nylon – with the mesh size approximately 1½ inch (1¼ –1¾) (38 mm).
3. Net Placement: mist nets extend approximately from water or ground level to tree canopy and are bounded by foliage on the sides. Net width and height are adjusted for the fullest coverage of the flight corridor at each site. A "typical" net set consists of three (or more) nets "stacked" on top of one another; width may vary up to 60 feet (20 m).
4. Net Site Spacing:
   - Streams – one net site per 0.5 mile (1 km)
   - Land Tracts – two net sites per 250 acres (1 square km)
5. Minimum Level of Effort Per Net Site:
   - Two net locations (sets) per net site, with locations (sets) at least 100 feet (30 m) apart
   - Two (calendar) nights of netting
   - At least three net–nights (1 net–night = 1 net set deployed for 1 night); typically, two net sets are deployed at one site for two nights, resulting in four net-nights
   - Sample Period: begin at dusk and net for 5 hours (approximately 0200h)
   - Nets are monitored at approximately 20-minute intervals
   - No disturbances near the nets between checks
6. Weather Conditions: net only if the following weather conditions are met:
   - No precipitation
   - Temperature $\geq$ 10°C (50°F)
   - No strong winds
7. Moonlight: avoid net sets with direct exposure to a moon ½ -full or greater – typically by utilizing forest canopy cover

Source: U.S. Fish and Wildlife Service

Mist net sites were also selected based upon habitat characterizations described for the Indiana bat and Virginia big-eared bat in current literature and experience of ESI personnel with these species. Habitat with the following characteristics was selected to the degree feasible:

- Large trees (>16 inches dbh) for maternity roosts
- An open canopy, apparently important for warming Indiana bat roost sites
- An open, uncluttered understory, used for travel and forage

6.4.1 Bat Capture

The netting setup allows bats to be caught live and released unharmed near the point of capture. Bats were identified to species using a combination of morphological characteristics (e.g., ear and tragus, calcar, pelage, size/weight, length of right forearm, and overall appearance of the animal). The species, sex, reproductive condition, age, weight, length of right forearm, and time and location of capture were recorded for all bats captured. Age (adult or juvenile) of bats is determined by examining ephiphyseal-diaphyseal fusion (calcification) of long bones in the wing. Weight was measured to 0.1 grams using a Pesola spring scale. Length of right forearm was measured to the nearest 0.1 or 1.0 mm using a dial calipers or metric ruler, respectively. The reproductive condition of captured bats was classified as non-descended male, descended male, non-reproductive female, pregnant female (based on gentle abdominal palpation), lactating female, or post-lactating female. Bats were not banded. Bat processing and data collection was typically completed within 30 minutes of the time the bat was removed from the net. Data recorded in the field are provided in Appendix D.

6.4.2 Flying Squirrel Capture

Mist nets are predominantly deployed at night to capture bats. Sometimes non-target species are also captured, including nocturnal birds, moths, beetles, and flying squirrels. Although netting was not specifically intended for (nor was the sampling designed for) the capture of flying squirrels, they can be caught as they use volplane in open portions of the forest, including corridors used by bats (Brack and Mumford 1983). If flying squirrels are captured, they are released unharmed after being identified to species and processed for morphometric data. Data for non-target species was recorded on bat capture data sheets (Appendix D).

Flying squirrels are identified to species using a combination of morphological characteristics (e.g., pelage color, size/weight, hind foot length, tail length, and overall appearance of the animal). Species, sex, reproductive condition, age, weight, length of tail, length of hind foot, and time and net site of capture are recorded. Information is typically collected within 30 minutes of the time that squirrels are removed from the net.

6.4.3 Weather

Weather conditions were monitored each night of survey. Conditions recorded include: temperature, wind speed and direction, percent cloud cover, and moon phase (if visible). A standard mercury thermometer was used to record temperature, wind speed was determined by use of the Beaufort wind scale, and cloud cover was estimated. Appendix E contains completed Weather Data Sheets.

In general, precipitation and cloud cover were average and temperatures slightly below average across the region. A trend of decreasing temperature persisted during the four calendar nights of netting. High and low temperatures during the survey are listed in Table 5. The average high during July for the nearby city of Beckley, West Virginia is normally 80°F; the average low is normally 61°F. Weather conditions during each survey night fell within netting parameters as outlined by the USFWS (1999). On the last night of netting (16 July 2004), the temperature dropped to 50°F by 0200 h, just after both nets were taken down. Wind speeds varied between 0 and 3 mph during all survey nights, except on 14 July when winds reached speeds up to 15 mph. Nighttime skies ranged from clear to cloudy. A new moon persisted during the entire netting period. Appendix E contains completed Weather Data Sheets.

Table 2. Weather Data.

Netting Dates (2004)	High Temp. (°F)	Low Temp. (°F)
13 July	70	62
14 July	66	64
15 July	60	54
16 July	60	50

7.0 Results

7.1 Bat Habitat Assessment

Separate habitat assessments were completed for each site in the project area. Appendix A contains completed Habitat Description data sheets for endangered bats.

7.1.1 Rainelle

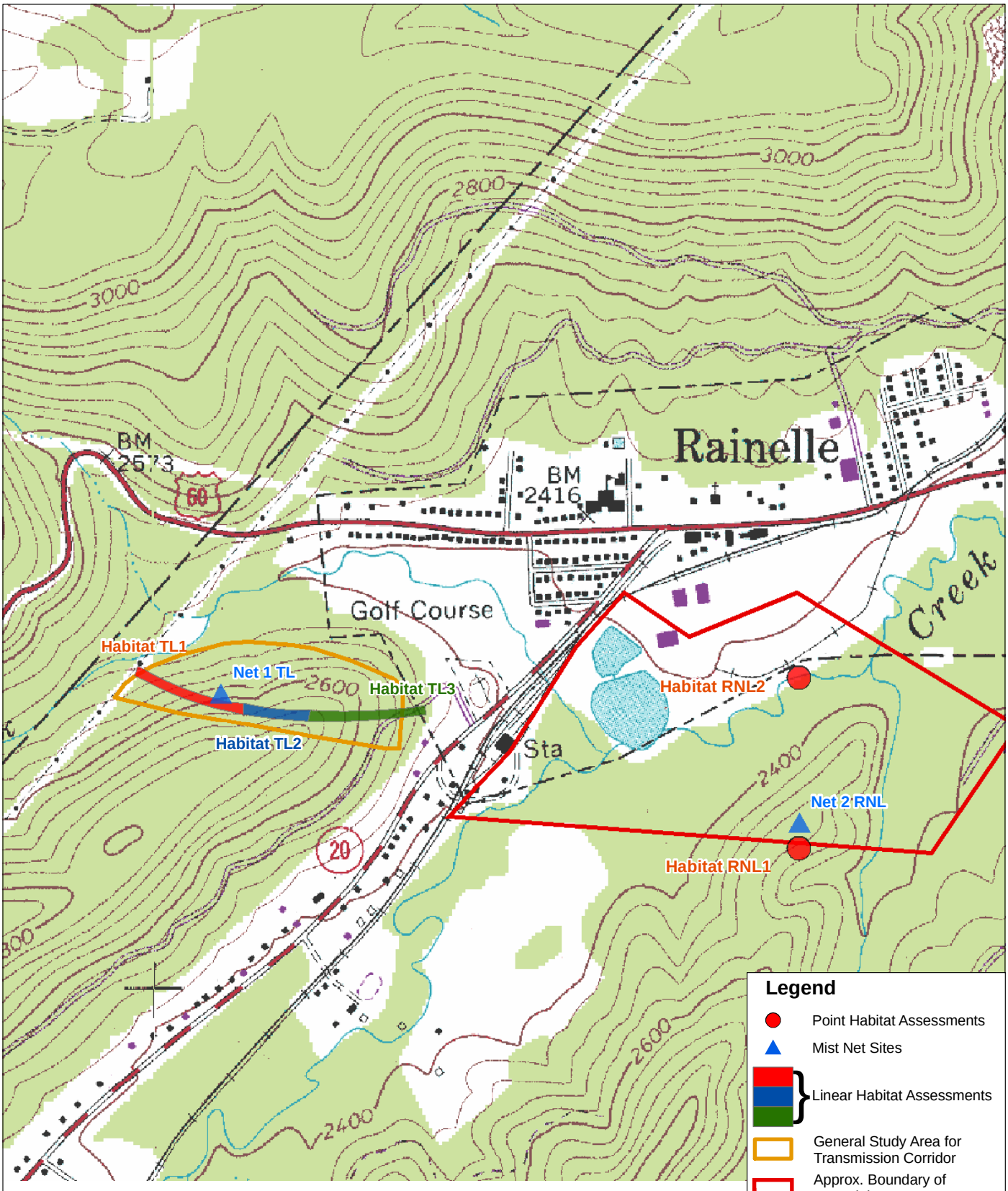
Rainelle Site #01 (RNL1) was located in a wooded area to the south of the proposed Rainelle Power Plant, on the south side of Sewell Creek. This 40-acre piece of land is an upland forest with a thick canopy and little undergrowth. Overstory tree species include sugar maple, black oak, tulip poplar, and American beech. The understory is very open beneath, and consists of herbaceous cover such as ferns, violets, and grape vines (*Vitis* spp.). Possible roosting habitat for the Indiana bat does exist in this area, including large trees and snags. Roost tree potential is considered moderate, due to the presence and abundance of these trees. Upland foraging habitat is available for many species of bats. Figure 3 identifies the specific location of RNL1 within the project area.

Rainelle Site #02 (RNL2) was located in a moderately disturbed area along Sewell Creek. This area consists of small, early successional trees such as black willow (*Salix nigra*) and black locust. Assorted weeds, grasses, goldenrods (*Solidago* spp.), blackberry (*Rubus* spp.), and greenbrier (*Smilax* sp.) comprise the understory. No large overstory trees are present. Roost potential for Indiana bats was considered low. Figure 3 identifies the specific location of RNL2 within the project area.

7.1.2 Transmission Line

The proposed transmission line corridor runs east-to-west across Wolf Pen Ridge on Sewell Mountain. Bat habitat assessments were completed in three segments.

Transmission Line Site #01 (TL1) was located on the west side of Sewell Mountain. The hillside consists of a mature upland deciduous forest with large and small canopy trees and a moderately cluttered understory. Dominant overstory species include American beech, black cherry, and tulip poplar. Subdominant overstory species include American beech, mountain magnolia (*Magnolia fraseri*), and sugar maple. Many suitable roosting cavities are present within the large trees in this area. The understory is sparse, containing some American beech and witchhazel (*Hamamelis virginiana*), which lends to good flight corridors for foraging bats. Ferns and violets



Source: West Virginia University Data Clearinghouse

Base map: USGS DOQQ Quad map Rainelle, WV

N W E S

Figure 3: Location of Net Sites and Habitat Assessments at the Rainelle and Transmission Line Corridor Project Areas, Greenbrier County, West Virginia.

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comprise much of the herbaceous cover. Roost tree potential for the Indiana bat was considered moderate. Figure 3 identifies the specific location of TL1 within the project area.

Transmission Line Site #02 (TL2) was on top of Wolf Pen Ridge on Sewell Mountain. The habitat was a young upland deciduous forest with many smaller trees reaching into the canopy. Dominant overstory species include northern red oak, sugar maple, and tulip poplar. Subdominant overstory species include American beech, sugar maple, and black cherry. The subcanopy was considered moderately cluttered. Very few flight corridors were present, thus foraging potential was low for Indiana and Virginia big-eared bats. Moderate potential for Indiana bat roosting does exist, due to the presence of some large trees and snags. Figure 3 identifies the specific location of TL2 within the project area.

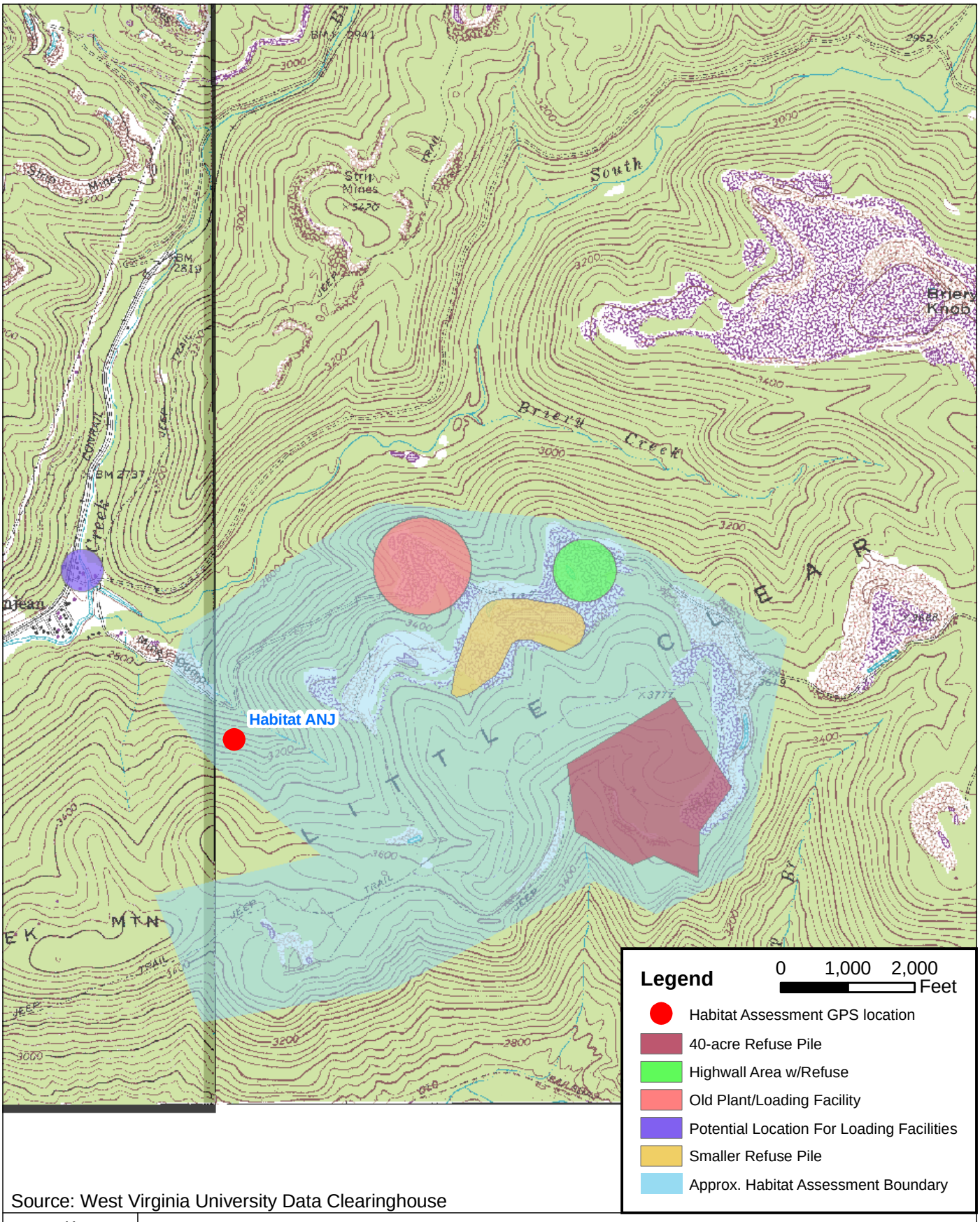
Transmission Line Site #03 (TL3) was on the east side of Sewell Mountain. The hillside consisted of a young upland deciduous forest with mostly small trees reaching to the canopy. Dominant overstory species included shagbark hickory (*Carya ovata*), sugar maple, and white oak. Subdominant overstory species include American beech, sugar maple, and tulip poplar. Roost tree potential for the Indiana bat was considered low. The subcanopy was closed and therefore was not ideal foraging habitat for bats. Figure 3 identifies the specific location of TL3 within the project area.

7.1.3 Anjean

Anjean Site #01 (ANJ1) was on Anjean Mountain at an abandoned surface mine. Habitat consisted of open areas and old fields primarily containing herbaceous weeds, grasses, and flowering plants. No large trees were present. Small trees such as black locust, red maple, and sugar maple were found scattered in the area. No mist netting was conducted at Anjean. A few abandoned buildings were inspected for bats, but no signs of bats or guano was found. Some large areas of exposed rock outcrops were present that could provide roosts for Virginia big-eared bats; however, the degraded foraging habitat nearby makes this unlikely. Roost potential for Indiana bats was low due to the lack of trees in the area. Figure 4 identifies the specific location of ANJ1 within the project area.

7.2 Flying Squirrel Habitat Assessment

Habitat assessments for Virginia northern flying squirrel were completed at the same times and locations as habitat assessments for endangered bats. Vegetation composition and analysis for flying squirrel sites is consistent with those described in Section 7.1. In addition, sites were searched for particular tree species favored by *G. s. fuscus*. Also, the potential for nesting sites and food availability was addressed.



Source: West Virginia University Data Clearinghouse

Figure 4: Location of Habitat Assessment at the Anjean Project Area, Greenbrier County, West Virginia.

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7.2.1 Rainelle

Rainelle Site #01 (RNL1) was surveyed for its ability to support a population of Virginia northern flying squirrels. Due to the disturbed nature of the site along Sewell Creek, Site #02 (RNL2) was not surveyed. RNL1 is at an elevation of 2,462 ft, which is below the lower limit at which *G. s. fuscus* is typically found (3,280 ft; 1,000 m), but within the elevation occasionally used (2,330 ft; 710 m). The 40-acre site is comprised of deciduous tree species. Species present used by *G. s. fuscus* include American beech, sugar maple, and black cherry. The understory is very open underneath, with numerous sugar maple saplings. Only one snag was seen during the assessment, and a few holes (that could serve as nest sites) were found in large sugar maples and American beeches. Some fungi were also found. Overall, nest site availability and foraging potential for *G. s. fuscus* was moderate. Figure 3 identifies the specific location of RNL1 within the project area.

7.2.2 Transmission Line

The proposed transmission line corridor runs east-to-west for approximately 2,000 ft across Sewell Mountain. At the time of this investigation, the corridor was not expected to exceed 75 ft (23 m) in width, thus giving a total maximum potential impact area of approximately 3.5 acres (1.4 ha). Assessment of Virginia northern flying squirrel habitat was completed in three segments in this area.

Transmission Line Site #01 (TL1) was at an elevation of 2,490 ft, which is below the lower limit at which *G. s. fuscus* is typically found (3,280 ft; 1,000 m), but within the elevation occasionally used (2,330 ft; 710 m). The site is comprised of primarily mesic, deciduous trees; however, several small eastern hemlocks (*Tsuga canadensis*) are present. Deciduous species present that are used by *G. s. fuscus* include birch (*Betula* spp.), American beech, sugar maple, and black cherry. Approximately 20 good snags were found. Natural cavities are plentiful in the large, hollow trees (primarily American beech) present in this area. Many fungi are present in the area. Ground cover consists of mostly rock outcrops and leaf litter with little herbaceous cover except ferns and mosses. Nest site availability for *G. s. fuscus* was considered high in this area; foraging potential was determined to be moderate. Figure 3 identifies the specific location of TL1 within the project area.

Transmission Line Site #2 (TL2) was on the ridge top of Sewell Mountain at an elevation of 2,700 ft to 2,750 ft, which is within the range occasionally occupied by *G. s. fuscus*. The site is comprised of deciduous tree species. Species present that are used by *G. s. fuscus* include American beech, sugar maple, and black cherry. Snags, natural nest cavities, and lichens/fungi were present, although less abundant than on the west side of the mountain (TL1). In this area, nest site availability and foraging potential for *G. s. fuscus* were considered moderate. Figure 3 identifies the specific location of TL2 within the project area.

Transmission Line Site #3 (TL3) was at an elevation between 2,593 ft to 2,724 ft, which is within the range occasionally occupied by *G. s. fuscus*. The site is comprised of deciduous tree species. Species present that are used by *G. s. fuscus* include American beech, sugar maple, and black cherry. The forest on this side of the mountain was younger than on the west side; most trees were of small diameter. Snags, natural nest cavities, and lichens/fungi were present, although much less abundant than on the west side of the mountain (TL1). In this area, nest site availability and foraging potential for *G. s. fuscus* was determined to be low. Figure 3 identifies the specific location of TL3 within the project area.

7.2.3 Anjean

Anjean Site #01 (ANJ1) is a highly disturbed site, due to previous surface mining activities. ANJ1 was located at an elevation between 2,750 ft to 3,769 ft, which is within the range occasionally occupied by *G. s. fuscus*. Abundant new growth and weedy ground cover were present. All trees in the area were deciduous and of small diameter. There were very few snags or trees with natural cavities. Nest site availability and foraging potential for *G. s. fuscus* was low. Figure 4 identifies the specific location of ANJ1 within the project area.

7.3 Visual Inventory of Mammals

No endangered or threatened species were encountered. A total of 7 mammal species were observed (visually or by animal sign) during pedestrian surveys of the three project areas. Many of the animals observed are common in woodlands, open fields, and disturbed habitats such as those in the project areas. Evidence of white-tailed deer (*Odocoileus virginianus*) was found at all sites. During the survey, a black bear (*Ursa americanus*) was seen at the Anjean site. West Virginia DNR considers this species “uncommon”, or seldom seen due to the lack of suitable habitat and/or its secretive nature. Appendix C contains completed Mammal Inventory Checklists.

Table 3. Mammals observed in the project areas during pedestrian surveys on 24 June 2004.

Sites	Common Name	Scientific Name	Observation Method
Rainelle (Sites 1 & 2)	Eastern gray squirrel	*Sciurus carolinensis*	Visual
	Common raccoon	*Procyon lotor*	Tracks
	White-tailed deer	*Odocoileus virginianus*	Tracks
Transmission Line (Sites 1 – 3)	Eastern chipmunk	*Tamias striatus*	Visual
	Eastern cottontail	*Sylvilagus floridana*	Scat
	White-tailed deer	*Odocoileus virginianus*	Tracks
Anjean	Eastern chipmunk	*Tamias striatus*	Visual
	Groundhog	*Marmota monax*	Visual
	Black bear	*Ursa americanus*	Visual
	White-tailed deer	*Odocoileus virginianus*	Tracks

7.4 Mist Netting

Two mist net sites, located at Rainelle and in the vicinity of the transmission line corridor, were selected to provide sufficient coverage of the project areas. The Transmission Line net site (Net 1 TL) was located on an old logging road that traversed Sewell Mountain in an east-to-west direction. Bats could potentially use this trail as a flight corridor. Nets were placed near the ridge top. Typically, one net site is required per linear kilometer of corridor; however, since the transmission line corridor is less than 1 kilometer, only one site was needed. The Rainelle net site (Net 2 RNL) was located on a recently improved logging road in the off-site wooded area (south of Sewell Creek), near an adjacent ridge top. Both sites were surveyed for two nights each during the period 13 to 16 July 2004. Figure 3 identifies the specific locations of each mist net site.

7.4.1 Bat Capture

No endangered bats were captured during the survey efforts. Only 3 bats representing 2 species were caught in the nets, including the big brown bat (*Eptesicus fuscus*) and northern bat (*Myotis septentrionalis*). A red bat (*Lasiurus borealis*) was seen flying in the vicinity of a net, but was not caught. Evidence of reproduction, namely reproductive (lactating) females or juveniles, was found at each site. Information regarding sex, age, and reproductive status for all bats is included in Table 3. Bats were caught at both net sites (Table 4). Appendix D contains completed Bat Capture Data Sheets.

Table 4. Bat captures by species, sex, and age between 13 and 16 July 2004.

Species	Adult Male	Lac[1] Female	PL or NR[2] Female	Juvenile	Escape[3]	Total
Big brown bat	1	0	0	1	0	**2**
Red bat	0	0	0	0	1	**1**
Northern bat	0	1	0	0	0	**1**
Total	**1**	**1**	**0**	**1**	**1**	**4**

1 Lactating
2 Post-Lactating or Nonreproductive
3 Seen in vicinity of net, but was not captured or processed

Table 5. Bat captures by net site and date.

Site	Date	Big brown bat	Northern bat
Transmission Line Corridor (Net 1 TL)	13 July 2004	1	1
	14 July 2004	0	0
Rainelle (Net 2 RNL)	15 July 2004	0	0
	16 July 2004	1	0

7.4.2 Flying Squirrel Capture

No flying squirrels were caught during mist net surveys at either of the locations.

8.0 Discussion and Conclusions

To investigate potential presence of the Indiana bat, Virginia big-eared bat, and Virginia northern flying squirrel, habitat assessments and mist net surveys were conducted at various portions of the project area, including the vicinity of the proposed power plant, the proposed transmission line corridor, and adjacent property where development might occur. All-inclusive mammal inventories were also conducted at each area using pedestrian surveys. Habitat assessments focused on determining the potential for use by the above-mentioned endangered species. Mist net survey sites were used to survey for bats (and incidentally for flying squirrels), focusing on areas that provided suitable traveling and foraging habitat. No endangered or threatened species were seen or captured during these assessments or surveys performed in June and July 2004.

8.1 Indiana Bat

Netting efforts provided no evidence that Indiana bats use the project area during summer months. The species complement, diversity, and number of bats captured in the project area were very low, which could be indicative of relatively poor habitat in this geographic location. Brack et al. (2002) found that the occurrence of reproductive females of several species of bats was lower at higher elevations in the Appalachian Mountains. The low catch of northern bats was surprising, for they are often relatively common in woodland areas. Big brown bats, which were two of the three captures, are common residents of areas that have been disturbed, and are often found in or near human residences or structures. Of the bats captured, both sexes and age classes (adult and juvenile) were represented, indicating evidence of reproduction in the area.

Habitat at the Rainelle location is of moderate value for the Indiana bat, due to the presence of large trees and snags that could serve as potential roosts. This suitable habitat is only located off-site (in a nearby wooded area on the south side of Sewell Creek known as the Plum Creek Property), outside of the power plant development footprint (which is on the north side of Sewell Creek). Roosting and foraging potential is low to moderate in the vicinity of the transmission corridor, and varies depending on aspect and position. Possible roosting areas are located on the west side and ridge top of the mountain, due to the presence of some larger trees and snags. Roosting and foraging potential at the Anjean facility is low, due to the disturbed nature of the area and lack of suitable vegetation.

Based upon the known presence of the Indiana bat in Greenbrier County, presence of reproductively active females in nearby (≈50 miles west) Boone County, but the apparent absence of the Indiana bat in the survey area, a May Affect – Not Likely to Adversely Affect determination is anticipated from the U.S. Fish and Wildlife Service.

8.2 Virginia Big-eared Bat

Netting efforts provided no evidence that Virginia big-eared bats use the project area during summer months. Unlike Indiana bats, these bats are usually found in association with caves that are required for summer roosting (as well as winter hibernation). Foraging potential for these bats is considered low to moderate at all sites in the project areas. Roosting potential is low due to the apparent absence of suitable caves. Man-made structures and rock outcrops at the Anjean site contained no signs of use by bats, including the Virginia big-eared bat.

Occasional occurrence of this species is possible due to migratory and foraging behavior; however, based upon the closest occurrence of the Virginia big-eared bat being at least 60 miles south, a May Affect – Not Likely to Adversely Affect determination is anticipated from the U.S. Fish and Wildlife Service.

8.3 Virginia Northern Flying Squirrel

Visual searches and subsequent mist netting efforts provided no evidence that Virginia northern flying squirrels are present in the project areas; however, these animals are shy, secretive, and rarely encountered. Assessments of squirrel habitat were therefore performed in all areas. Assessment criteria were based on elevation, habitat type, the presence and abundance of snags, large trees and/or natural cavities, and lichens/fungi, a known food source.

Most elevations in the Anjean and Rainelle project areas are below those typically used by *G. s. fuscus*, although they are within elevations that are occasionally used. Similarly, the habitat type (hardwood forest) of both areas is not typically used by the species, although it is occasionally used. Some parts of Anjean (i.e., the mountaintop) are within the typical elevation range of *G. s. fuscus* (>3,280 feet). At the time of survey, the Anjean project area lacked suitable habitat for foraging and nesting; however, reclamation efforts are currently planned. Planting suitable tree species and installing nest boxes in the area could benefit the species.

The proposed location for the co-generation facility on the north side of Sewell Creek contained no suitable habitat for *G. s. fuscus*, and thus was not considered suitable for the squirrel. Wooded areas adjacent to the proposed co-generation site (on the south side of Sewell Creek) were of only moderate value for foraging and nesting, which when combined with elevation and habitat type consideration, provides a habitat of low quality.

Along the transmission line corridor, foraging potential and nest site availability ranged from high to low along various portions of the line. Generally, habitat was less favorable for the squirrel as Sewell Mountain is traversed up and down the ridge from west to east. The entire corridor is above the lower limit that *G. s. fuscus* is occasionally found (>2,330 feet); however, the typical elevation range for the species (>3,280 feet) is only reached close to the ridge top. The western slope is comprised

of several species of mature hardwood trees used by the species when coniferous species are not available. Natural tree cavities, snags, and potential food sources for *G. s. fuscus* were abundant only on the western slope; the ridge top and eastern slope of Sewell Mountain represent marginal to poor potential (respectively) for the presence of *G. s. fuscus*. The ridge top and eastern side of the mountain have some species of hardwoods used by the squirrel. Natural cavities, snags, and potential food sources are much less abundant than on the western slope. Overall, a corridor of 75 feet wide would only remove approximately 3.5 acres of total habitat on Sewell Mountain.

In summary, the Virginia northern flying squirrel is known from the region, although the closest known population is on Bearwallow Knob in northern Greenbrier County, West Virginia, which is approximately 28 kilometers (17.5 miles) northeast of the Anjean project area (Jennifer Wykle, WVDNR, pers. comm., 2005). In general, the project areas currently contain poor to moderate roosting and foraging potential at elevations below those most frequently used by the species. They are predominantly hardwood habitat, which is used less frequently by the squirrel than conifers. Only approximately one-third of the transmission line corridor, on the western slope of Sewell Mountain, contains hardwood habitat with good foraging and roosting potential, although it is at an elevation below that most frequently used by *G. s. fuscus*. In total, the transmission line includes only about 3.5 acres, and the portion of the corridor on the west side of the mountain is only about one-third this, or less than 1.2 acres. In addition, mist netting and visual inventories failed to document the presence of any flying squirrels within the project areas. Based on these criteria, a May Affect – Not Likely to Adversely Affect determination is anticipated from the U.S. Fish and Wildlife Service.

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Appendix A

Completed Bat Habitat Description Data Sheets

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781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

HABITAT DESCRIPTION

Project No. _____ **Date:** 24 JUNE 2004 **Initials:** M.Gillen & P.Johnson

State/County WV - Greenbrier | **Site #:** Rainelle - woods off site #01 (also Net 2 RNL)

GPS: Longitude: N 37° 57' 40.3" Latitude: W 80° 46' 31.1"

Distance to water: _____ Quad name: _____

ESTIMATED STREAM CHARACTERISTICS:

Bank Height: _____ Channel Width: _____ Stream Width: _____

Substratum: ☐ Sand ☐ Gravel ☐ Cobble ☐ Bedrock ☐ Silt/mud other _____

Average Water Depth: _____ Clarity: ☐ High ☐ Moderate ☐ Low

VEGETATION:

Estimated Canopy Closure: ☒ Closed ☐ Moderate ☐ Open

Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg: 30" dbh Sm 16" dbh

1. Acer saccharum
2. Quercus velutina
3. Liriodendron tulipifera

Roost Tree Potential – Large Trees and Snags: ☐ High ☒ Moderate ☐ Low

Subdominant Overstory Species (<38cm/15"):

1. Acer saccharum 2. Fagus grandifolia 3. —

Relative Abundance of Dominant vs. Subdominant: 20:80

Subcanopy Clutter: ☐ Closed ☒ Moderate ☐ Open

Is Subcanopy Vegetation Lay Comprised Largely of: ☐ Lower Branches of Canopy Trees? ☒ Saplings ☐ Shrubs

Dominant Understory Species: 1. A. saccharum 2. — 3. — Very open understory

Description of Habitat Form:

Upland hardwood forest with thick canopy & little understory growth - leaf litter dense. Nice habitat with roosts & foraging potential for M. Sodalis

Herbaceous Cover: Ferns, violets, grapevine

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HABITAT DESCRIPTION

Photo - Sewell Creek 100-1396

Project No. _____ **Date:** 24 June 2004 **Initials:** MG & PJ

State/County WV - Greenbrier | **Site #:** Rainelle - Sewell Creek #02

GPS: Longitude: N 37° 57' 52.5" Latitude: W 80° 46' 31.1"

Distance to water: ON H2O Quad name: _____

ESTIMATED STREAM CHARACTERISTICS: SEWELL CREEK

Bank Height: 10ft Channel Width: 30ft Stream Width: 15ft

Substratum: ☒ Sand ☐ Gravel ☐ Cobble ☐ Bedrock ☐ Silt/mud other _____

Average Water Depth: 3ft Clarity: ☐ High ☒ Moderate ☐ Low

VEGETATION:

Estimated Canopy Closure: ☐ Closed ☐ Moderate ☒ Open

Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg: — dbh Sm — dbh

1. NONE
2. _____
3. _____

Roost Tree Potential – Large Trees and Snags: ☐ High ☐ Moderate ☒ Low

Subdominant Overstory Species (<38cm/15"):

1. Salix nigra 2. Robinia pseudoacacia 3. _____

Relative Abundance of Dominant vs. Subdominant: 0:100%

Subcanopy Clutter: ☐ Closed ☐ Moderate ☒ Open

Is Subcanopy Vegetation Lay Comprised Largely of: ☐ Lower Branches of Canopy Trees? ☐ Saplings ☒ Shrubs

Dominant Understory Species: 1. Dogwood shrubs 2. _____ 3. _____

Description of Habitat Form:

Disturbed. Early successional growth with mostly black locust, shrubs, & weeds along banks.

Herbaceous Cover: Grasses, goldenrod (Solidago), blackberry (Rubus), greenbrier (Smilax)

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HABITAT DESCRIPTION

Project No. 115.02 **Date:** 7-13-04 **Initials:** CL & MG

State/County WV - Greenbrier **Site #:** Trans Line Net Site (Net 1 TL)

GPS: Longitude: N 32° 52' 516" Latitude: W 80° 42' 234"

Distance to water: 1000 ft Quad name:

ESTIMATED STREAM CHARACTERISTICS: Wolf Pen Creek

Bank Height: 3-5 ft Channel Width: 7 ft Stream Width: 5 ft

Substratum: ☒ Sand ☐ Gravel ☐ Cobble ☐ Bedrock ☐ Silt/mud other ____

Average Water Depth: 1 ft Clarity: ☐ High ☒ Moderate ☐ Low

VEGETATION:

Estimated Canopy Closure: ☒ Closed ☐ Moderate ☐ Open

Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg: 50" dbh Sm 16" dbh

1. Fagus grandifolia
2. Liriodendron tulipifera
3. Acer saccharum

& Prunus serotina (Cherry)

Roost Tree Potential – Large Trees and Snags: ☒ High ☐ Moderate ☐ Low

→ Many large hollow trees & snags

Subdominant Overstory Species (<38cm/15"):

1. F. grandifolia 2. A. saccharum 3. L. tulipifera

Relative Abundance of Dominant vs. Subdominant: 50:50

Subcanopy Clutter: ☐ Closed ☐ Moderate ☒ Open

Is Subcanopy Vegetation Lay Comprised Largely of: ☒ Lower Branches of Canopy Trees? ☐ Saplings ☐ Shrubs

Dominant Understory Species: 1. F. grandifolia
2. Magnolia fraseri
3. A. saccharum

Description of Habitat Form:
Mature Upland hardwood forest with many large trees & open mid/under story. Snags abundant & flight corridors exist (ATV trail & 2 skid roads)

Herbaceous Cover: Very sparse. Dense leaf litter. Some ferns & maple leaf

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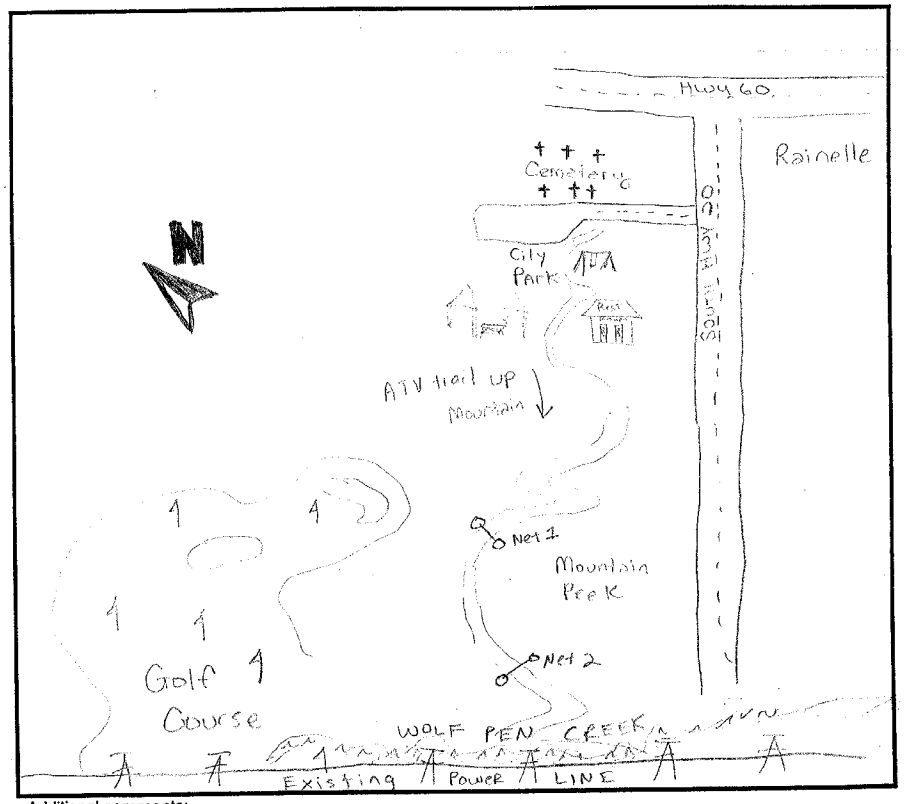
Please draw a map of the portal location. Include land features such as streams, forests, roads (hardtop and mine access), railroads, spoil piles, houses, any other relevant structures or features, and ANABAT placement. Include a north arrow and an estimated scale.

Problem Area and AMLF #(s): ____



Additional comments:

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HABITAT DESCRIPTION

Project No. _____ **Date:** 24 JUNE 2004 **Initials:** M Gillen

State/County WV/Greenbriar	**Site #:** Transmission Line #01

GPS: Longitude: N 37° 57' 52.8" Latitude: W 80° 47' 30.8"

Distance to water: 250 ft Quad name:

ESTIMATED STREAM CHARACTERISTICS: DID NOT SEE ANY STREAMS

Bank Height: _____ Channel Width: _____ Stream Width: _____

Substratum: ☐ Sand ☐ Gravel ☐ Cobble ☐ Bedrock ☐ Silt/mud other _____

Average Water Depth: _____ Clarity: ☐ High ☐ Moderate ☐ Low

VEGETATION:

Estimated Canopy Closure: ☐ Closed ☒ Moderate ☐ Open

Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg: ___ dbh Sm ___ dbh

1. Fagus grandifolia
2. Prunus serotina
3. Liriodendron tulipifera

Roost Tree Potential – Large Trees and Snags: ☐ High ☒ Moderate ☐ Low

Subdominant Overstory Species (<38cm/15"):

1. F. grandifolia 2. Magnolia fraseri 3. Acer saccharum

Relative Abundance of Dominant vs. Subdominant: 15% : 85%

Subcanopy Clutter: ☐ Closed ☒ Moderate ☐ Open

Is Subcanopy Vegetation Lay Comprised Largely of: ☐ Lower Branches of Canopy Trees?

☒ Saplings ☐ Shrubs

Dominant Understory Species: 1. F. grandifolia
2. Witch hazel
3. _____

Description of Habitat Form:

Upland hardwood forest. Mostly large beech. Habitat provides many good roosting cavities. Multiple large hollow beech trees. Undergrowth sparse - many good flight corridors.

Herbaceous Cover: Christmas fern, mosses, violets

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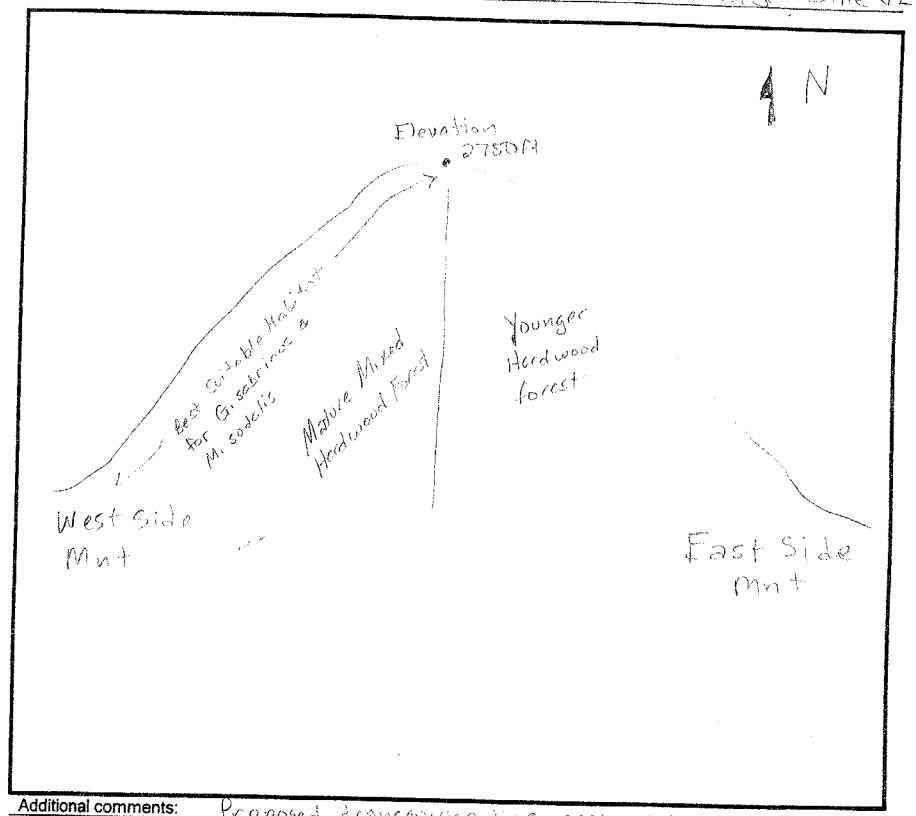
Please draw a map of the portal location. Include land features such as streams, forests, roads (hardtop and mine access), railroads, spoil piles, houses, any other relevant structures or features, and ANABAT placement. Include a north arrow and an estimated scale.

Problem Area and AMLF #(s): Sewell Mnt Transmission Line (TL1)



Additional comments: Proposed transmission line goes up & over Mountain. 100ft ROW

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HABITAT DESCRIPTION

Project No. _____ **Date:** 24 JUNE 2004 **Initials:** MGilley

State/County WV Greenbrier | **Site #:** Transmission Line #02

GPS: Longitude: N 37° 57' 50.4" Latitude: W 80° 47' 21.0"

Distance to water: 1000ft. Quad name:

ESTIMATED STREAM CHARACTERISTICS:

Bank Height: _____ Channel Width: _____ Stream Width: _____

Substratum: ☐ Sand ☐ Gravel ☐ Cobble ☐ Bedrock ☐ Silt/mud other _____

Wolf Pen Creek

Average Water Depth: _____ Clarity: ☐ High ☐ Moderate ☐ Low

VEGETATION:

Estimated Canopy Closure: ☐ Closed ☒ Moderate ☐ Open

Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg: __ dbh Sm __ dbh

1. Quercus rubrum
2. Acer saccharum
3. Liriodendron tulipifera

Lg Sharpest x Dbh

Roost Tree Potential -- Large Trees and Snags: ☐ High ☒ Moderate ☐ Low

Subdominant Overstory Species (<38cm/15"):

1. Fagus grandifolia 2. Acer saccharum 3. Prunus serotina

Relative Abundance of Dominant vs. Subdominant: 25:75%

Subcanopy Clutter: ☐ Closed ☒ Moderate ☐ Open

Is Subcanopy Vegetation Lay Comprised Largely of: ☐ Lower Branches of Canopy Trees?

☒ Saplings ☐ Shrubs

Dominant Understory Species: 1. A. saccharum
2. Vitis spp.
3. F. grandifolia

Description of Habitat Form:
Young mixed hardwood forest

Herbaceous Cover: Ferns, violets, mosses

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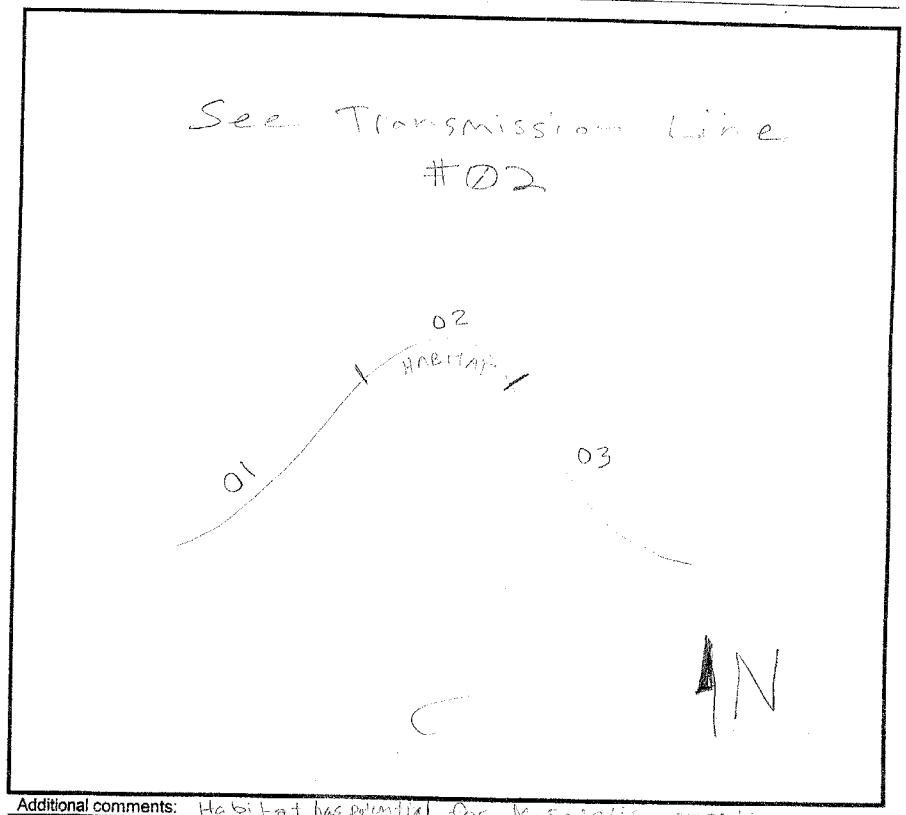
Please draw a map of the portal location. Include land features such as streams, forests, roads (hardtop and mine access), railroads, spoil piles, houses, any other relevant structures or features, and ANABAT placement. Include a north arrow and an estimated scale.

Problem Area and AMLF #(s): TL2



Additional comments: Habitat has potential for M. Septentrionalis - Foraging potential not as good. No good corridors - Habitat that good for C. townsendii

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HABITAT DESCRIPTION

Project No. _____ **Date:** 24 June 2004 **Initials:** M. Gilley

State/County WV - Greenbriar | **Site #:** Transmission Line #03

GPS: Longitude: N 37° 57' 50.3" Latitude: W 80° 47' 04.6"

Distance to water: 1500 ft Quad name:

ESTIMATED STREAM CHARACTERISTICS: Wolf Pen Creek

Bank Height: _____ Channel Width: _____ Stream Width: _____

Substratum: ☐ Sand ☐ Gravel ☐ Cobble ☐ Bedrock ☐ Silt/mud other _____

Average Water Depth: _____ Clarity: ☐ High ☐ Moderate ☐ Low

VEGETATION:

Estimated Canopy Closure: ☐ Closed ☐ Moderate ☐ Open

Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg: __ dbh Sm __ dbh

1. Carya ovata
2. Acer saccharum
3. Quercus alba

Roost Tree Potential – Large Trees and Snags: ☐ High ☐ Moderate ☒ Low

Subdominant Overstory Species (<38cm/15"):

1. Fagus grandifolia 2. Acer saccharum 3. L. tulipifera

Relative Abundance of Dominant vs. Subdominant: 10:90%

Subcanopy Clutter: ☒ Closed ☐ Moderate ☐ Open

Is Subcanopy Vegetation Lay Comprised Largely of: ☐ Lower Branches of Canopy Trees?

☒ Saplings ☐ Shrubs

Dominant Understory Species: 1. A. saccharum
2. —
3. —

Description of Habitat Form:

Young upland deciduous forest

Herbaceous Cover: Ferns, small A. pennsylvanicum & A. saccharum

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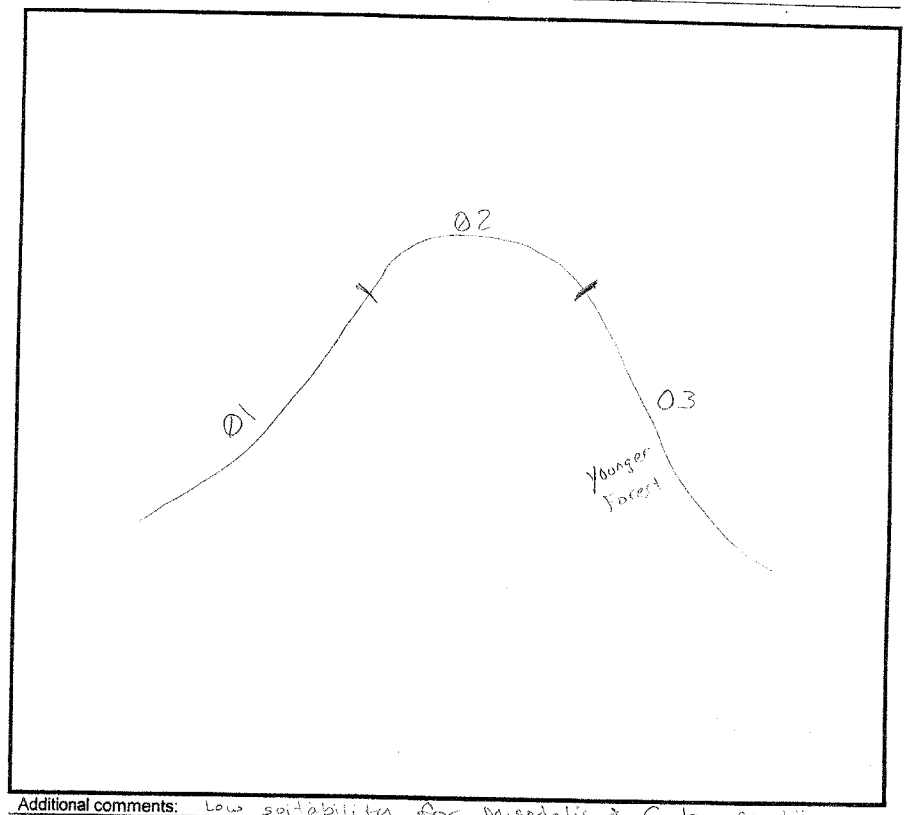
Please draw a map of the portal location. Include land features such as streams, forests, roads (hardtop and mine access), railroads, spoil piles, houses, any other relevant structures or features, and ANABAT placement. Include a north arrow and an estimated scale.

Problem Area and AMLF #(s): See Transmission Line #03



Additional comments: Low suitability for M. sodalis & C. townsendii.
** Sight at bottom of E. side of ridge landed have a couple of large hollow trees

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HABITAT DESCRIPTION

Project No. _____ **Date:** 24 JUNE 2004 **Initials:** MG & PJ

State/County WV - Greenbriar **Site #:** Anjean #01

GPS: Longitude: N 38° 01' 00.8" Latitude: W 80° 37' 25.8"

Distance to water: Quad name:

ESTIMATED STREAM CHARACTERISTICS:

Bank Height: _____ Channel Width: _____ Stream Width: _____

Substratum: ☐ Sand ☐ Gravel ☑ Cobble ☐ Bedrock ☐ Silt/mud other _____

Average Water Depth: _____ Clarity: ☐ High ☐ Moderate ☐ Low

VEGETATION:

Estimated Canopy Closure: ☐ Closed ☐ Moderate ☒ Open

Dominant Overstory Species (>38cm/15"): Estimated DBH range: Lg: — dbh Sm — dbh

1. NONE - All Need Growth
2.
3.

Roost Tree Potential – Large Trees and Snags: ☐ High ☐ Moderate ☒ Low

Subdominant Overstory Species (<38cm/15"):

1. Robinia pseudoacacia 2. Acer rubrum 3. Acer saccharum

Relative Abundance of Dominant vs. Subdominant: 0:100%

Subcanopy Clutter: ☒ Closed ☐ Moderate ☐ Open

Is Subcanopy Vegetation Lay Comprised Largely of: ☐ Lower Branches of Canopy Trees?
☒ Saplings ☒ Shrubs

Dominant Understory Species: 1. Acer saccharum
2. R. pseudoacacia
3. _____

Description of Habitat Form:
Few abandoned building - No bats or guano observed
Buildings do provide potential roost sites for C. townsendii. Anjean site also contained some large exposed rock outcrops - but due to disturbed habitat surrounding outcrops - not likely good roosting sight for C. townsendii

Herbaceous Cover: Grasses, Goldenrod (Solidago sp.)

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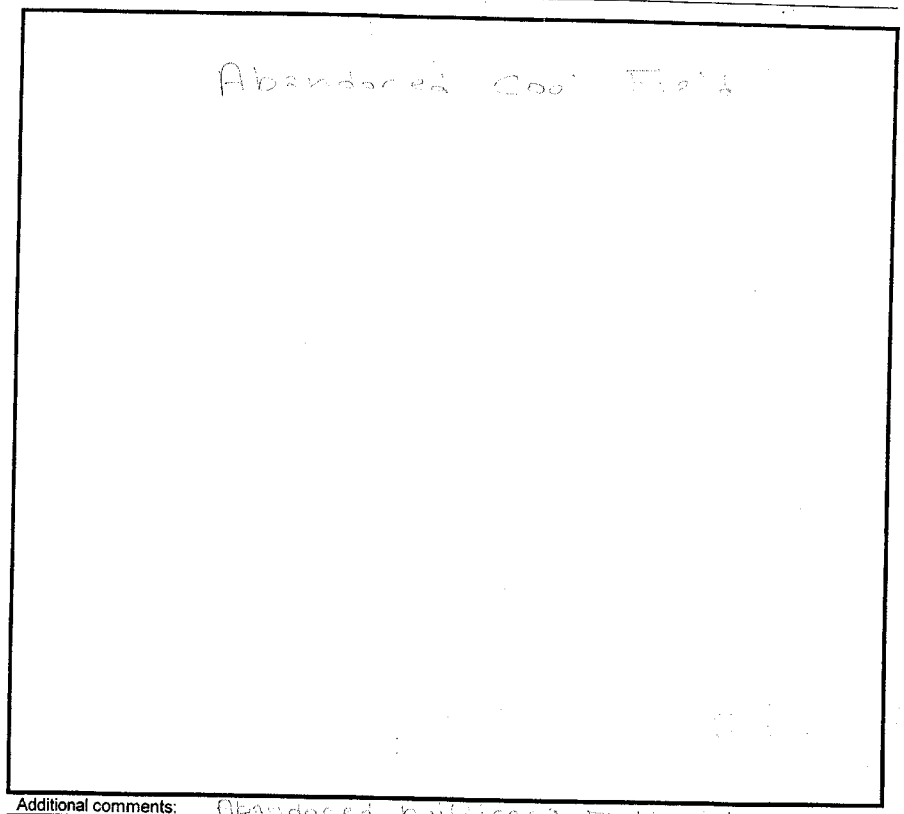
Please draw a map of the portal location. Include land features such as streams, forests, roads (hardtop and mine access), railroads, spoil piles, houses, any other relevant structures or features, and ANABAT placement. Include a north arrow and an estimated scale.

Problem Area and AMLF #(s): _____



Additional comments: Abandoned buildings & rock outcrops could provide suitable habitat for Virginia big-eared bats.

Appendix B

Completed Flying Squirrel Habitat Description Data Sheets

ESI

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Photos

HABITAT DESCRIPTION
Glaucomys sabrinus

Project Name Potomac-Hudson — Date: 24 JUNE 2004

Biologist(s) M. Gilley & P. Johnson — Site: 01 Rainelle 3 Units off site → many purchases for buffer

State/County WV - Greenbrier Co.

GPS: Longitude: N 37° 57' 40.3" — Latitude: W 80° 46' 31.1"

Elevation 2426ft (> 1000 – 1300m) — Water Source/Distance Sewell Creek

VEGETATION: % Mature conifers (1) — % Mature Hardwoods 100%

Dominant Overstory	Subdominant Overstory
1. Acer saccharum	1. Acer saccharum
2. Quercus velutina	2. Fagus grandifolia
3. Liriodendron tulipifera	3.

Presence of Preferred Species: (West Virginia)

Conifers	Hardwoods
☐ Red Spruce	☐ Birch
☐ Fir	☑ Beech
☐ Hemlock	☑ Sugar Maple — prolific seedlings
	☑ Black Cherry — saplings

→ Very little → open understory

Understory (shrubs & young saplings)	Herbaceous Cover
1. A. saccharum	1. Ferns
2.	2. Violets
3.	3. Viola

Presence of Snags: NO - saw only one

Presence of Natural Cavities: Few hollow holes in maple, beech

Presence of Lichens & Fungi: Some fungi

Nest Site Availability: Low (Medium) High

Foraging Potential: Low (Medium) High

Site - ridge side with mostly maple - several logs on ground.

732 619 054

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Photos - 100-4378 - habitat
100-4379 - Potential Nest Sites
100-4380
100-4381

HABITAT DESCRIPTION
Glaucomys sabrinus

Project Name Potomac-Hudson — Date: 24 JUNE 2004

Biologist(s) M. Gilley & P. Johnson — Site: Transmission Line #01 on Sewell Mnt.

State/County WV - Greenbrier Co.

GPS: Longitude: N 37° 57' 52.8" — Latitude: W 80° 47' 30.8" Center Line

Elevation 2490ft (> 1000 – 1300m) — Water Source/Distance Wolfpen Creek 250ft

* Elevation a little low.

VEGETATION: % Mature conifers 0% — % Mature Hardwoods 100%

Dominant Overstory	Subdominant Overstory
1. Fagus grandifolia	1. Fagus grandifolia
2. Prunus serotina	2. Magnolia fraseri
3. Liriodendron tulipifera	3. Acer saccharum

Presence of Preferred Species: (West Virginia) — See Recovery Plan

Conifers	Hardwoods
☐ Red Spruce	☑ Birch (Mature) Abundant
☐ Fir	☑ Beech N 37° 57' 52.8" W 80° 47' 30.8"
☑ Hemlock (young saplings)	☑ Sugar Maple (young)
	☑ Black Cherry (young) Abundant large pole sized

Understory (shrubs & young saplings)
1. F. grandifolia
2. Witch hazel
3.

Herbaceous Cover
1. Christmas fern & other ferns
2. Moss on rock
3. Viola spp. — Abundance of rocky outcrops

Presence of Snags: Yes - counted 18-20 good snags

Presence of Natural Cavities: Yes - MANY hollow trees present - mostly Beech

Presence of Lichens & Fungi: YES - many fungi

Nest Site Availability: Low Medium (High)

Foraging Potential: Low (Medium) High

Ground - Mostly rock outcrops & steep hills. Little herbaceous cover.
** Many downed logs

Southern Boundary of ROW N 37 57 49.5 W 80 47 31.3

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HABITAT DESCRIPTION
Glaucomys sabrinus

Project Name Potomac - Hudson

Date: 24 June 2004

Biologist(s) M. Gilley & P. Johnson

Site: Transmission line #02

State/County WV / Greenbrier Co

GPS: Longitude: N 37° 57' 50.4"

Latitude: W 80° 47' 21.0"

Elevation 2700 ft (> 1000 – 1300m) MAX Elevation 2950

Water Source/Distance Wolfpen Creek 1000 ft

VEGETATION: % Mature conifers Ø

% Mature Hardwoods 100%

Dominant Overstory

1. Quercus rubrum
2. Acer saccharum
3. Liriodendron tulipifera

Subdominant Overstory

1. Fagus grandifolia
2. Acer saccharum
3. Prunus serotina
   Yellow birch

Presence of Preferred Species: (West Virginia)

Conifers - NONE

- ☐ Red Spruce
- ☐ Fir
- ☐ Hemlock

Hardwoods

- ☑ Birch
- ☑ Beech
- ☑ Sugar Maple
- ☑ Black Cherry

} Abundant

Understory (shrubs & young saplings)

1. Acer saccharum
2. Vitis spp
3. Fagus grandifolia
   Acer - striped maple

Herbaceous Cover

1. Christmas fern & other ferns
2. Viola spp.
3. Mosses

III

Presence of Snags: YES

Presence of Natural Cavities: YES

Presence of Lichens & Fungi: YES

All less abundant than West side of Mountain

Nest Site Availability: Low (Medium) High

Foraging Potential: Low (Medium) High

ESI

Property of: Environmental Solutions & Innovations, Inc.
781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

HABITAT DESCRIPTION
Glaucomys sabrinus

Project Name Potomac - Hudson

Date: 24 June 2004

Biologist(s) M. Gilley & P. Johnson

Site: Transmission Line #03

State/County WV - Greenbriar

GPS: Longitude: N 37° 57' 50.3"

Latitude: W 80° 47' 04.6"

Elevation 2724 ft to 2593 (> 1000 – 1300m)

Water Source/Distance Wolfpen Creek 1500 ft

VEGETATION: % Mature conifers Ø

% Mature Hardwoods 100%

Dominant Overstory

1. Carya ovata
2. Acer saccharum
3. Quercus alba
4. Prunus serotina

Subdominant Overstory

1. Fagus grandifolia
2. Acer saccharum
3. Liriodendron tulipifera

Presence of Preferred Species: (West Virginia)

Conifers

- ☐ Red Spruce
- ☐ Fir
- ☐ Hemlock

Hardwoods

- ☑ Birch
- ☑ Beech
- ☑ Sugar Maple
- ☑ Black Cherry

} Abundant

Understory (shrubs & young saplings)

1. A. saccharum
2.
3.

Herbaceous Cover

1. Ferns
2. Acer pennsylvanicum
3. Acer saccharum

IIII

Presence of Snags: YES - 5-10 snags

Presence of Natural Cavities: YES - observed 2 or 5

IIII

Presence of Lichens & Fungi: YES - less abundant on east side of mountain

Nest Site Availability: (Low) Medium High

Foraging Potential: (Low) Medium High

Notes: East side of mountain - younger hardwood stand - more ground cover, DBH range 5-15" most trees - few > 16"

Property of: Environmental Solutions & Innovations, Inc.
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HABITAT DESCRIPTION

Glaucomys sabrinus

Photos - 100-1387 coal
- 100-4383 - rock wall
100-4384 - sediment pond
100-4386 - vegetation

Project Name Potomac-Hudson

Date: 24 JUNE 2004

Biologist(s) M. Gilley & P. Johnson

Site: Anjean #01

State/County WV - Greenbrier Co.

ON - Anjean Inst.

GPS: Longitude: N 38° 01' 00.8"

Latitude: W 80° 37' 25.8"

Elevation MAX - 3769 ft - Top Coal
MIN - 3150ft (> 1000 – 1300m)

Water Source/Distance Big Clear Creek
Briery Creek

VEGETATION: % Mature conifers 0 %

% Mature Hardwoods 100 %

Dominant Overstory - NONE - all new growth

1.
2.
3.

Subdominant Overstory

1. Robinia pseudoacacia
2. Acer rubrum
3. Acer saccharum

Presence of Preferred Species: (West Virginia)

Conifers

- ☐ Red Spruce
- ☐ Fir
- ☐ Hemlock

Hardwoods

- ☐ Birch
- ☐ Beech
- ☒ Sugar Maple - Striped & Red
- ☒ Black Cherry - Fire Cherry

Understory (shrubs & young saplings)

1. Acer saccharum
2. Robinia pseudoacacia
3.

Herbaceous Cover

1. Solidago sp.
2. Vetch
3. Rubus spp.
4. Vitis spp.

Presence of Snags: Very few < 5

Presence of Natural Cavities: NO

Presence of Lichens & Fungi: NONE observed - Ground cover dense with goldenrod & vetch

Nest Site Availability: (Low) Medium High

Foraging Potential: (Low) Medium High

Site - mined for coal. Alot of new growth & dense ground cover (mostly weeds). Some exposed rock walls.

Appendix C

Completed Mammal Inventory Checklists

Mammals observed by:
V = visual
T = tracks
S = scat

Rainelle - offsite & on Sewell Cr.
#01 - 02

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ORDER DIDELPHIMORPHIA -Marsupials

Family Didelphidae - New World Opossums

_____ Virginia Opossum C
(Didelphis virginiana)

ORDER INSECTIVORA -Shrews and Moles

Family Soricidae-Shrews

_____ Masked Shrew C
Sorex cinereus

_____ Southeastern Shrew U
Sorex longirostris

_____ Smoky Shrew U
Sorex fumeus

_____ Long-tailed Shrew U
Sorex dispar

_____ Water Shrew R
Sorex palustris

_____ Pygmy Shrew U
Sorex hoyi

_____ Northern Short-tailed Shrew C
Blarina brevicauda

_____ Least Shrew R
Cryptotis parva

Family Talpidae -Moles

_____ Hairy-tailed Mole C
Parascalops breweri

_____ Eastern Mole U
Scalopus aquaticus

_____ Star-nosed Mole U
Condylura cristata

ORDER CHIROPTERA -Bats

Family Vespertilionidae -Common Bats

_____ Little Brown Myotis C
Myotis lucifugus

_____ Northern Myotis U
Myotis septentrionalis

_____ Indiana Myotis R
Myotis sodalis

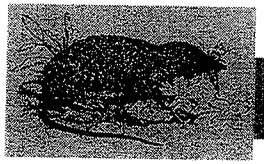
_____ Eastern Small-footed Myotis R
Myotis leibii

_____ Gray Myotis R
Myotis grisescens

_____ Silver-haired Bat U
Lasionycteris noctivagans

_____ Eastern Pipistrelle C
Pipistrellus subflavus

_____ Big Brown Bat C
Eptesicus fuscus



_____ Eastern Red Bat C
Lasiurus borealis

_____ Hoary Bat U
Lasiurus cinereus

_____ Evening Bat R
Nycticeius humeralis

_____ Rafinesque's Big-eared Bat R
Corynorhinus rafinesquii

_____ Virginia Big-eared Bat R
Corynorhinus townsendii

ORDER RODENTIA -Rodents

Family Sciuridae -Squirrels

_____ Eastern Chipmunk C
Tamias striatus

_____ Woodchuck/ Groundhog C
Marmota monax

V ✓ Eastern Gray Squirrel C
Sciurus carolinensis

_____ Fox Squirrel C
Sciurus niger

_____ Red Squirrel C
Tamiasciurus hudsonicus

_____ Southern Flying Squirrel C
Glaucomys volans

_____ WV Northern Flying Squirrel R
Glaucomys sabrinus

Family Castoridae -Beavers

_____ American Beaver C
Castor canadensis

Family Dipodidae -Jumping Mice*

_____ Meadow Jumping Mouse U
Zapus hudsonius

_____ Woodland Jumping Mouse C
Napaeozapus insignis

Family Muridae Mice and Rats

Subfamily Sigmodontinae (New World mice and rats)

_____ Eastern Harvest Mouse R
Reithrodontomys humulis

_____ Deer Mouse C
Peromyscus maniculatus

_____ White-footed Mouse C
Peromyscus leucopus

_____ Golden Mouse U
Ochrotomys nuttalli

_____ Allegheny Wood Rat U
Neotoma magister

Subfamily Arvicolinae (Voles, lemmings, muskrats)

_____ Southern Bog Lemming U
Synaptomys cooperi

_____ Southern Red-backed Vole C
Clethrionomys gapperi

_____ Meadow Vole C
Microtus pennsylvanicus

_____ Rock Vole U
Microtus chrotorrhinus

_____ Woodland Vole/ Pine Vole C
Microtus pinetorum

_____ Prairie Vole R
Microtus ochrogaster

_____ Muskrat C
Ondatra zibethicus

Subfamily Murinae (Old World mice and rats)

_____ House Mouse E
Mus musculus

_____ Norway Rat E
Rattus norvegicus

_____ Black Rat E
Rattus rattus

Family Erethizontidae -New World Porcupines

_____ Common Porcupine R
Erethizon dorsatum

ORDER LAGOMORPHA-Lagomorphs

Family Leporidae -Hares and Rabbits

_____ Snowshoe Hare U
Lepus americanus

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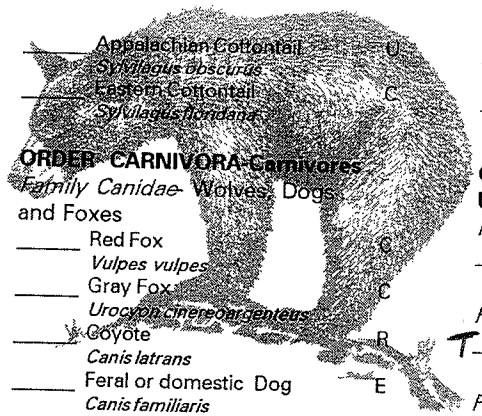
Rainelle #01-02 (continued)



_____ Appalachian Cottontail U
Sylvilagus obscurus
_____ Eastern Cottontail C
Sylvilagus floridanus

ORDER CARNIVORA-Carnivores

Family Canidae- Wolves, Dogs and Foxes

_____ Red Fox C
Vulpes vulpes
_____ Gray Fox C
Urocyon cinereoargenteus
_____ Coyote R
Canis latrans
_____ Feral or domestic Dog E
Canis familiaris

Family Ursidae-Bears

_____ Black Bear U
Ursus americanus

Family Procyonidae -Racoons and Ring-tails

_____ Common Raccoon C
Procyon lotor

Family Mustelidae -Mustelids

_____ Least Weasel U
Mustela nivalis
_____ Long-tailed Weasel U
Mustela frenata
_____ Mink U
Mustela vison
_____ Fisher R
Martes pennanti
_____ River Otter R
Lutra canadensis
Extirpated, Reintroduced

Family Mephitidae -Skunks

_____ Eastern Spotted Skunk U
Spilogale putorius
_____ Striped Skunk C
Mephitis mephitis

Family Felidae -Cats

_____ Bobcat U
Lynx rufus

_____ Mountain Lion or Cougar
Puma concolor *Extirpated*
_____ Feral or house cat E
Felis catus

ORDER ARTIODACTYLA-Even-toed Ungulates

Family Suidae -Pigs

_____ Wild Boar/ Feral Pig E
Sus scrofa

Family Cervidae -Cervids

_____ White-tailed Deer C
Odocoileus virginianus

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*formerly *Zapodidae*, reduced to subfamily *Zapodinae*

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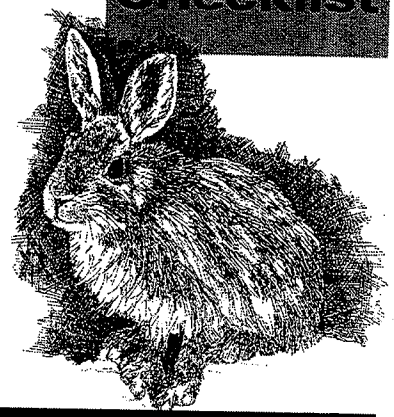
10/2001 5M

Mammals Of West Virginia

A Field Checklist



Published by the
West Virginia Division of
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Site - Transmission Line 01-03
Sewell Mountain

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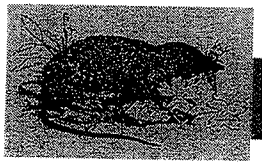

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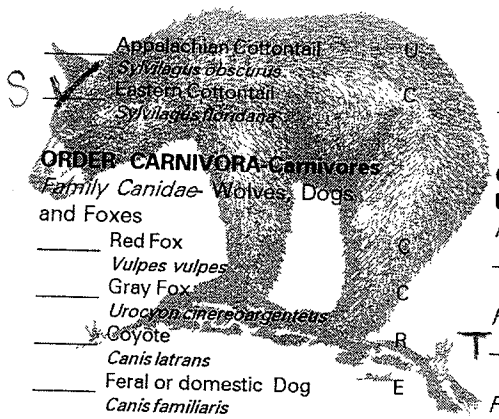

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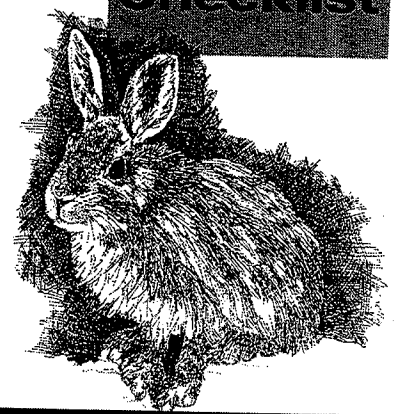

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Anjean Mountain

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_____ Water Shrew R
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Cryptotis parva

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_____ Silver-haired Bat U
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Pipistrellus subflavus
_____ Big Brown Bat C
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Corynorhinus rafinesquii
_____ Virginia Big-eared Bat R
Corynorhinus townsendii

ORDER RODENTIA -Rodents

Family Sciuridae -Squirrels

V ✓ Eastern Chipmunk C
Tamias striatus
V ✓ Woodchuck/ Groundhog C
Marmota monax
_____ Eastern Gray Squirrel C
Sciurus carolinensis
_____ Fox Squirrel C
Sciurus niger
_____ Red Squirrel C
Tamiasciurus hudsonicus
_____ Southern Flying Squirrel C
Glaucomys volans
_____ WV Northern Flying Squirrel R
Glaucomys sabrinus

Family Castoridae -Beavers

_____ American Beaver C
Castor canadensis

Family Dipodidae -Jumping Mice*

_____ Meadow Jumping Mouse U
Zapus hudsonius
_____ Woodland Jumping Mouse C
Napaeozapus insignis

Family Muridae Mice and Rats

Subfamily Sigmodontinae (New World mice and rats)

_____ Eastern Harvest Mouse R
Reithrodontomys humulis
_____ Deer Mouse C
Peromyscus maniculatus
_____ White-footed Mouse C
Peromyscus leucopus
_____ Golden Mouse U
Ochrotomys nuttalli
_____ Allegheny Wood Rat U
Neotoma magister

Subfamily Arvicolinae (Voles, lemmings, muskrats)

_____ Southern Bog Lemming U
Synaptomys cooperi
_____ Southern Red-backed Vole C
Clethrionomys gapperi
_____ Meadow Vole C
Microtus pennsylvanicus
_____ Rock Vole U
Microtus chrotorrhinus
_____ Woodland Vole/ Pine Vole C
Microtus pinetorum
_____ Prairie Vole R
Microtus ochrogaster
_____ Muskrat C
Ondatra zibethicus

Subfamily Murinae (Old World mice and rats)

_____ House Mouse E
Mus musculus
_____ Norway Rat E
Rattus norvegicus
_____ Black Rat E
Rattus rattus

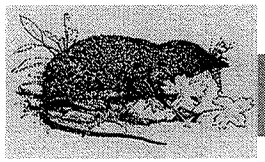
Family Erethizontidae -New World Porcupines

_____ Common Porcupine R
Erethizon dorsatum

ORDER LAGOMORPHA-Lagomorphs

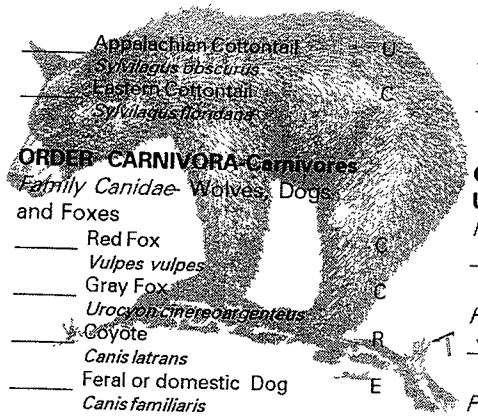
Family Leporidae -Hares and Rabbits

_____ Snowshoe Hare U
Lepus americanus



If you should find or observe a rare species or one not listed here, please contact the WVDNR's Wildlife Diversity Program, P.O. Box 67, Elkins, WV 26241 or phone 304-637-0245.

Anjean #01 (continued)



_____ Appalachian Cottontail U
Sylvilagus obscurus
_____ Eastern Cottontail C
Sylvilagus floridanus

ORDER CARNIVORA-Carnivores

Family Canidae- Wolves, Dogs, and Foxes

_____ Red Fox C
Vulpes vulpes
_____ Gray Fox C
Urocyon cinereoargenteus
_____ Coyote R
Canis latrans
_____ Feral or domestic Dog E
Canis familiaris

Family Ursidae-Bears

Sean ✓ Black Bear U
Ursus americanus

Family Procyonidae -Racoons and Ring-tails

_____ Common Raccoon C
Procyon lotor

Family Mustelidae -Mustelids

_____ Least Weasel U
Mustela nivalis
_____ Long-tailed Weasel U
Mustela frenata
_____ Mink U
Mustela vison
_____ Fisher R
Martes pennanti
_____ River Otter R
Lutra canadensis
Extirpated, Reintroduced

Family Mephitidae -Skunks

_____ Eastern Spotted Skunk U
Spilogale putorius
_____ Striped Skunk C
Mephitis mephitis

Family Felidae -Cats

_____ Bobcat U
Lynx rufus

_____ Mountain Lion or Cougar
Puma concolor *Extirpated*
_____ Feral or house cat E
Felis catus

ORDER ARTIODACTYLA-Even-toed Ungulates

Family Suidae -Pigs

_____ Wild Boar/ Feral Pig E
Sus scrofa

Family Cervidae -Cervids

✓ White-tailed Deer C
Odocoileus virginianus

Family Bovidae -Goats

_____ Domesticated Goat E
Capra hircus

*formerly *Zapodidae*, reduced to subfamily *Zapodinae*

Suggested Literature for further information

A Field Guide to the Mammals by William H. Burt and Richard P. Grossenheider

The Audubon Society Field Guide to North American Mammals by John O. Whitaker, Jr.

The Mammals of North America by Ray Hall

Wild Mammals of North America edited by Joseph A. Chapman and George A. Feldhamer

Vertebrate Species of Concern in West Virginia. WVDNR publication

Taxonomic References:

Wilson & Reeder.1993. *Mammalian Species of the World*, Smithsonian Institution Press

Jones, Clyde, et al. 1997. Occasional Papers of the Museum 173: Revised checklist of North American mammals north of Mexico, 1997.

Whitaker, John O., Jr. and William J. Hamilton, 1998. *Mammals of the Eastern United States*, 3rd ed.

West Virginia is home to at least 70 different wild mammals, with sporadic, although unconfirmed reports of the presence of one other mammal-the eastern cougar. Four of West Virginia's mammals–the Virginia big-eared bat, Indiana bat, West Virginia northern flying squirrel and eastern cougar–are federally listed as endangered. Several additional species are rare in West Virginia and warrant close monitoring.

Three species of mammals no longer exist in West Virginia: the bison, elk and gray wolf. The last recorded bison in West Virginia was killed near Valley Head, Randolph County in 1825. Elk were reported near the headwaters of the Tygart and Greenbrier rivers as late as 1875, but were gone by 1890. Bounties were paid on wolves in West Virginia as late as 1822. The last recorded wolf was killed in 1900.

The beaver, fisher and river otter were also eradicated, but were reintroduced in the 1930s, 1969 and 1985, respectively. Wild boar were introduced into the state in 1971. Today a population of wild boar exists in Boone, Logan, Raleigh and Wyoming counties.

The black rat (roof rat), Norway rat and house mouse all came to the continental United States with settlers and traders. Dogs, cats and goats that have wandered off or were abandoned have formed wild, or feral, populations in portions of the state.

Just as man's activities have resulted in the decline and extinction of some mammals, these activities also have resulted in increased abundance and range expansion of others. The opossum is more abundant and more widely distributed due to man's activities, as are mammals that prefer farm and early successional habitats. The coyote has expanded its range eastward across the Mississippi River and now occurs throughout the Mountain State.

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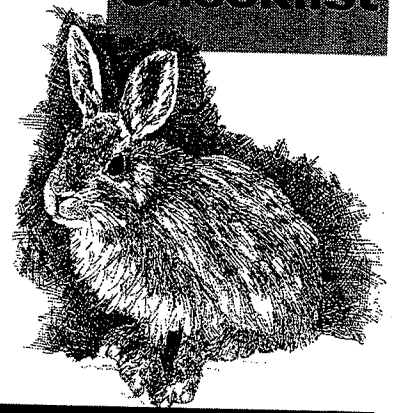
10/2001 5M

Mammals Of West Virginia

A Field Checklist



Published by the
West Virginia Division of
Natural Resources
Wildlife Resources Section

Appendix D

Completed Bat Capture Data Sheets

Property of: Environmental Solutions & Innovations, Inc
781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

BAT CAPTURE DATA

Project No.: 115.02 **Project Name:** Potomac - Hudson Page 1 of 1
Date: 7-13-04 **Biologists:** Gilley, Leftwich **Camera #** _____
State: WV **County:** Greenbriar **Site ID:** Transmission line
GPS –degrees-minutes-seconds
GPS: Latitude: N 37° 57' 51 6" Longitude: W 80° 47' 23 4" **ANABAT System #** _____

Trap #	Net #	Net type	Length	Height	Time Up	Time Down
	1	Mono / Old Nylon / New Nylon	18	20	2030	0150
	2	Mono / Old Nylon / New Nylon	18	20	2040	0150
		Mono / Old Nylon / New Nylon				

Site Description/Comments: Both nets over skidder trail midway up hillside

Capt #	Species	Time (2400)	Age Ad or Jv	Sex M/F	Repro-condition	Wt (g)	RFA (mm)	Belly: F, M, E	Feces Sample Y/N	Picture #
1	Eptesicus fuscus (1)	2100	Ad	M	↓	16.5	43.1	M	Y	—
2	Myotis septentrionalis (2)	2320	Ad	M	L	7.5	36.9	E	Y	—

Revised: 9 September 2002

Property of: Environmental Solutions & Innovations, Inc
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BAT CAPTURE DATA

Project No.: 115.02 **Project Name:** Potomac Hudson Page 1 of 1
Date: 7-14-04 **Biologists:** Leftwich & Gilley **Camera #** _____
State: WV **County:** Greenbriar **Site ID:** Trans. Line
GPS –degrees-minutes-seconds
GPS: Latitude: N 37° 57' 51 6" Longitude: W 80° 47' 23 4" **ANABAT System #** _____

Trap #	Net #	Net type	Length	Height	Time Up	Time Down
	1	Mono / Old Nylon / New Nylon	18'	20'	2030	0140
	2	Mono / Old Nylon / New Nylon	18'	20'	2040	0140
		Mono / Old Nylon / New Nylon				

Site Description/Comments: _____

Capt #	Species	Time (2400)	Age Ad or Jv	Sex M/F	Repro-condition	Wt (g)	RFA (mm)	Belly: F, M, E	Feces Sample Y/N	Picture #
	No Data									

Revised: 9 September 2002

Property of: Environmental Solutions & Innovations, Inc
781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

BAT CAPTURE DATA

Project No.: 115.02 **Project Name:** Potomac - Hudson **Page** 1 of 1
Date: 7-15-04 **Biologists:** Billy Leftwich **Camera #** Unk (4419-4430)
State: WV **County:** Greenbrier **Site ID:** Rainelle
GPS –degrees-minutes-seconds
GPS: Latitude: N 37° 57' 42.1" Longitude: W 80° 46' 31.2" **ANABAT System #** NA

Trap #	Net #	Net type	Length	Height	Time Up	Time Down
	1	Mono / Old Nylon / New Nylon	18'	20'	2030	0150
	2	Mono / Old Nylon / New Nylon	18'	20'	2035	0150
		Mono / Old Nylon / New Nylon				

Site Description/Comments: Both nets over recently improved logging road; opening near ridge top

Capt #	Species	Time (2400)	Age Ad or Jv	Sex M/F	Repro-condition	Wt (g)	RFA (mm)	Belly: F, M, E	Feces Sample Y/N	Picture #
	No Captures									

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* Lasiurus borealis seen flying around net but not captured

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BAT CAPTURE DATA

Project No.: 115.02 **Project Name:** Potomac-Hudson **Page** 1 of 1
Date: 7-16-04 **Biologists:** Gilley - Leftwich **Camera #**
State: WV **County:** Greenbrier **Site ID:** Rainelle
GPS –degrees-minutes-seconds
GPS: Latitude: N 37° 57' 42.1" Longitude: W 80° 46' 31.2" **ANABAT System #**

Trap #	Net #	Net type	Length	Height	Time Up	Time Down
	1	Mono / Old Nylon / New Nylon	18'	20'	2050	0150
	2	Mono / Old Nylon / New Nylon	18'	20'	2045	0145
		Mono / Old Nylon / New Nylon				

Site Description/Comments:

Capt #	Species	Time (2400)	Age Ad or Jv	Sex M/F	Repro-condition	Wt (g)	RFA (mm)	Belly: F, M, E	Feces Sample Y/N	Picture #
1	Eptesicus fuscus	2130	SV	M	A	11.0	44.5	M		—

Revised: 9 September 2002

Appendix E

Completed Weather Data Sheets

Property of: Environmental Solutions & Innovations, LLC
781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

WEATHER DATA

Project No.: 115.02 Project Name: Potomac - Hudson
Date: 2-13-04 Biologists: LeFevre, Gilley
State: WV County: Greenbrier Site Name: Trans. Line.

Comments:

Moon Phase Quarter (see chart):

Time (2400 h)	Temp (°F)	Wind Speed (estimated – see chart)	Wind Direction: From ___ to ___	% Cloud Cover (estimated)	Comments (precip., humidity, etc)
2100	70	0	—	10	
2200	66	1	—	20	
2300	64	0	—	0	
2400	64	1	—	0	
0100	60	1-3	S to N	0%	
0200	62	0	—	0%	

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781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

WEATHER DATA

Project No.: 115.02 Project Name: Potomac - Hudson
Date: 2-14-04 Biologists: Gilley, LeFevre
State: WV County: Greenbrier Site Name: Trans. Line

Comments: Canopy too thick to determine cloud cover

Moon Phase Quarter (see chart):

Time (2400 h)	Temp (°F)	Wind Speed (estimated – see chart)	Wind Direction: From ___ to ___	% Cloud Cover (estimated)	Comments (precip., humidity, etc)
2100	66	6	SW - NE		
2200	65	4	SW - NE		
2300	64	4	SW - NE		
2400	64	10	SW - NE		
0100	64	15	SW - NE		winds getting gusty
0200	64	10	SW - NE		

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781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

WEATHER DATA

Project No.: 115.02 Project Name: Potomac - Appal
Date: 7-15-04 Biologists:
State: WV County: Greenbrier Site Name: Rainelle

Comments: Fog too dense to detect clouds

Moon Phase Quarter (see chart):

Time (2400 h)	Temp (°F)	Wind Speed (estimated – see chart)	Wind Direction: From ___ to ___	% Cloud Cover (estimated)	Comments (precip., humidity, etc)
2100	60	3	—		
2200	58	0	—		
2300	56	3	W-E		
2400	54	5	W-E		
0100	54	3	—		
0200	54	3	—		

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781 Neeb Road. Cincinnati, OH 45233 (Phone: 513-451-1777)

WEATHER DATA

Project No.: 115.02 Project Name: Potomac - Appal
Date: 7-16-04 Biologists: Grilley, Lefkovitz
State: WV County: Greenbrier Site Name: Rainelle

Comments:

Moon Phase Quarter (see chart):

Time (2400 h)	Temp (°F)	Wind Speed (estimated – see chart)	Wind Direction: From ___ to ___	% Cloud Cover (estimated)	Comments (precip., humidity, etc)
2100	60	2	—		
2200	56	0	—		
2300	55	1	—		
2400	52	1	—		
0100	51	0	—		
0200	50	2	—		

Appendix F

Study Plan submitted to USFWS

Environmental Solutions & Innovations, Inc.

Virgil Brack, Jr., Principal Scientist
781 Neeb Road
Cincinnati, OH 45233
Phone: (513) 451-1777; Fax: (513) 451-3321
E-mail: vbrack@EnvironmentalSI.com

Pesi115 13 July 2004

SENT VIA E-MAIL to barbara_Douglas@fws.gov

Ms. Barbara Douglas
Endangered Species Biologist
U.S. Fish and Wildlife Service
West Virginia Field Office
Elkins, WV 26241

RE: Survey 3 areas associated with a single project on Ranel Quadrangle, near Rainelle, West Virginia for the Indiana and Virginia big-eared bats (Site map attached)

1. **Transmission Line (<1 km) = 1 net site**
2. **Anjean: search abandoned buildings and cliff faces (netting completed only if hard evidence of bats is found in detailed search)**
3. **Rainelle: net 1 site at adjacent property that may be acquired (approx. 40 ac)**

Dear Ms Douglas:

This is a study plan from Environmental Solutions & Innovations, Inc. (ESI), to complete studies at the above referenced project areas. Taina Brack at ESI presented this information to you over the phone, when you gave preliminary approval based upon receipt of this information. ESI proposes to conduct these surveys based on that approval and approval of this plan.

Study Plan

Netting Survey

Netting will be in accordance with guidelines recommended by the Indiana Bat Recovery Team in the March 1999 Agency Draft Indiana Bat Recovery Plan. A summary of those guidelines follows.

NETTING GUIDELINES

1. Netting Season: 15 May to 15 August, when Indiana bats occupy summer habitat.
2. Equipment (Mist Nets): constructed of the finest, lowest visibility mesh commercially available – monofilament or black nylon – with the mesh size approximately 1½ inch (1¼ –1¾) (38 mm).
3. Net Placement: mist nets extend approximately from water or ground level to tree canopy and are bounded by foliage on the sides. Net width and height are adjusted for the fullest coverage of the flight corridor at each site. A "typical" net set consists of three (or more) nets "stacked" on top of one another; width may vary up to 60 feet (20 m).
4. Net Site Spacing:
   - Streams – one net site per 0.5 mile (1 km)
   - Land Tracts – two net sites per 250 acres (1 square km)
5. Minimum Level of Effort Per Net Site:
   - Two net locations (sets) per net site, with locations (sets) at least 100 feet (30 m) apart
   - Two (calendar) nights of netting
   - At least three net–nights (1 net–night = 1 net set deployed for 1 night); typically, two net sets are deployed at one site for two nights, resulting in four net-nights
   - Sample Period: begin at dusk and net for 5 hours (approximately 0200h)
   - Nets are monitored at approximately 20-minute intervals
   - No disturbance near the nets between checks
6. Weather Conditions: net only if the following weather conditions are met:
   - No precipitation
   - Temperature $\geq$ 10°C (50°F)
   - No strong winds
7. Moonlight: avoid net sets with direct exposure to a moon ½ -full or greater – typically by utilizing forest canopy cover

U.S. Fish and Wildlife Service, 1999 Agency Draft Recovery Plan

ESI will set mist nets to maximize coverage of flight paths used by bats along suitable travel corridors, foraging areas, and/or drinking areas. Riparian corridors are often used for travel or forage. However, upland corridors (e.g., trails or logging roads) also can provide suitable net sites. In upland areas, road ruts holding water have produced Indiana bats in many portions of the range. Site selection is based upon the extent of

canopy cover, presence of an open flyway, and forest conditions near the site. The actual location and orientation of each net is determined in the field.

Bats are live-caught in mist nets and released unharmed near the point of capture. When bats are captured, we identify species, sex, age class, and reproductive condition of each bat. We record weight and right forearm length of each individual. Age is determined by examining the ephiphyseal-diaphyseal fusion of long bones in the wing. Reproductive condition of female bats is recorded as pregnant (based on gentle abdominal palpation), lactating, post lactating, or non-reproductive. We also record time and location/net site of all bats captured. Processing is completed within 30 minutes of the time the bat is removed from the net.

Proposed Level of Effort

Area 1 is a corridor <1 km in length; we propose 1 net site.

Area 2 has essentially no suitable woodland habitat but does have some old buildings and rock cliffs that will be examined for bats. If evidence of bats (sightings or sign) is found, netting or trapping will be completed.

Area 3 has no suitable habitat and is comprised of shrubs and small black locust, however an adjacent block of land, about 40 ac in size, has suitable habitat. This tract could possible be acquired or "used" during project development or operation. We propose 1 net site.

Following netting guidelines, each site has 4 net nights. Each site has 2 net locations, at least 100 feet apart, run for two nights. Netting will be completed using "high" nets (20 to 30 feet). ESI uses pre-printed data sheets for recording bat captures, habitat evaluation, and weather. It will be the goal to place all net sites within project boundaries, however should adequate sites not exist within the project boundaries we will select sites no further than ½ km from the boundaries. ESI uses pre-printed data sheets for recording bat captures, habitat evaluation, and weather.

Habitat Survey

The Indiana bat seems most frequently to use woodlands with:

- Large trees (>16 inches dbh) for maternity roosts
- An open canopy, apparently important for warming roost sites
- An open, uncluttered understory, used for travel and forage

In addition, flight corridors and drinking water are often used by bats, and are the locations where netting is most frequently successful.

ESI will complete a habitat description of each study location. The emphasis of this description is habitat form: size and relative abundance of large trees and snags that potentially serve as roost trees, canopy closure, understory clutter/openness, water, and flight corridors. Habitat form is emphasized because the Indiana bat roosts in a great many species of trees. Tree species composition is included in the assessment. Species composition is important because it provides insight to edaphic conditions on site. For example, an oak-hickory stand references a different set of conditions than does a beech-maple stand.

ESI's habitat characterization does more than emphasize species of large trees near the net. It identifies components of the canopy and subcanopy layers. All trees reaching into the canopy are canopy trees, regardless of diameter/size. Dominant trees are the large trees in the canopy (>16" dbh) that have the greatest likelihood of being used by maternity colonies of Indiana bats. Smaller trees are often also found in the canopy, and the canopy can be entirely composed of smaller-diameter trees.

The subcanopy, or understory, vegetation layer is well defined in classical ecological literature. It is that portion of the forest structure between the ground vegetation (to approximately 2 feet (0.6 meters) and the canopy layers, usually beginning at about 25 feet (7.6 meters). Vegetation in the understory may come from:

- Lower branches of overstory trees
- Small trees that will grow into the overstory
- Small tress and shrubs that are confined to the understory

The amount of vegetation in the understory is termed clutter. Many species of bats, including the Indiana bat, tend to avoid areas of high clutter.

Each net site is documented with a sketch.

Thank you for your time and effort. If you have any questions, please call.

Sincerely,

Virgil Brack, Jr., Ph.D., Principal Scientist
Environmental Solutions & Innovations, Inc.